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Industry Power

A Putman Publication | "Executive Magazines for Industry"

FEBRUARY 1957

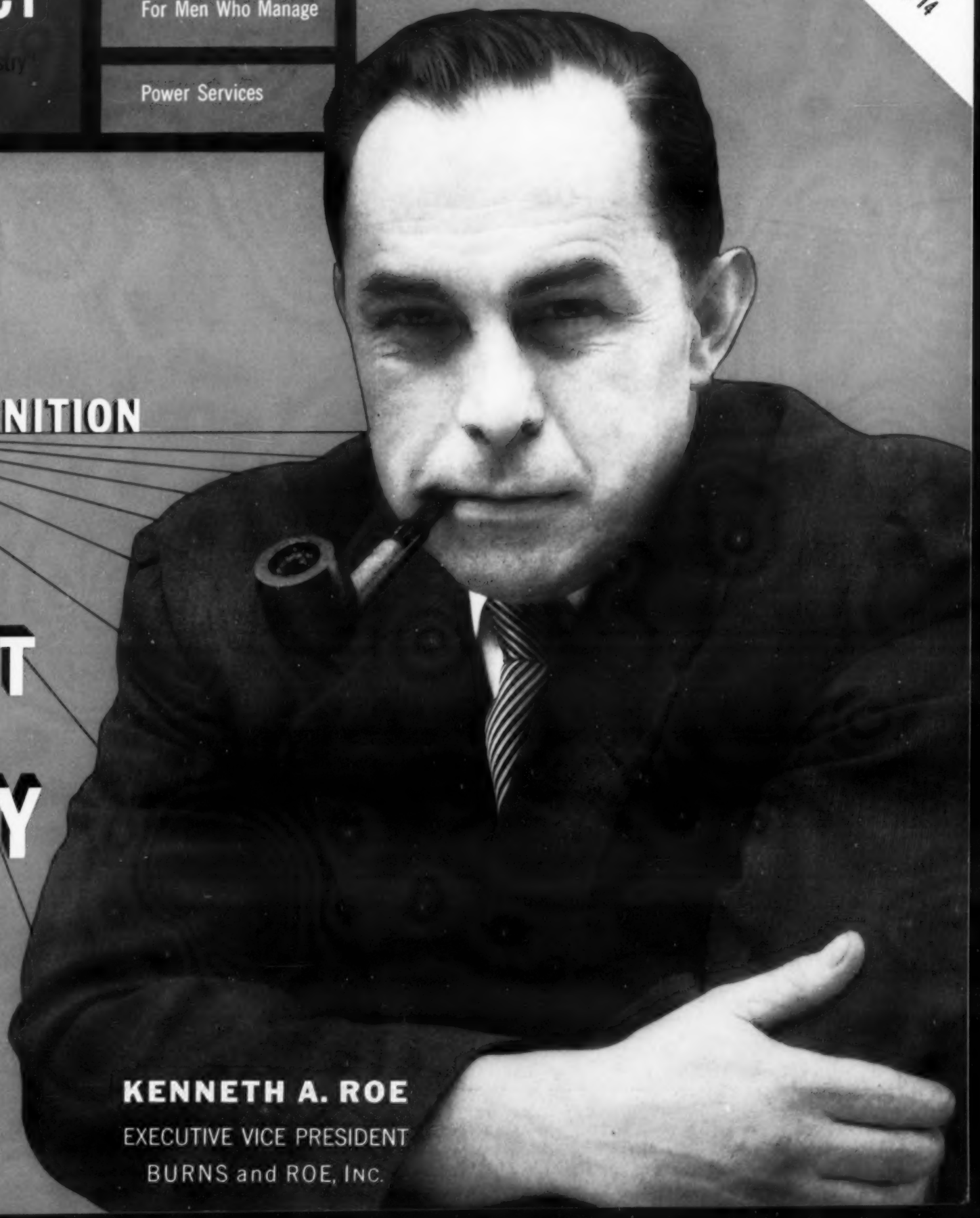
For Men Who Manage

Power Services

Now . . . analyzers for industry p 14

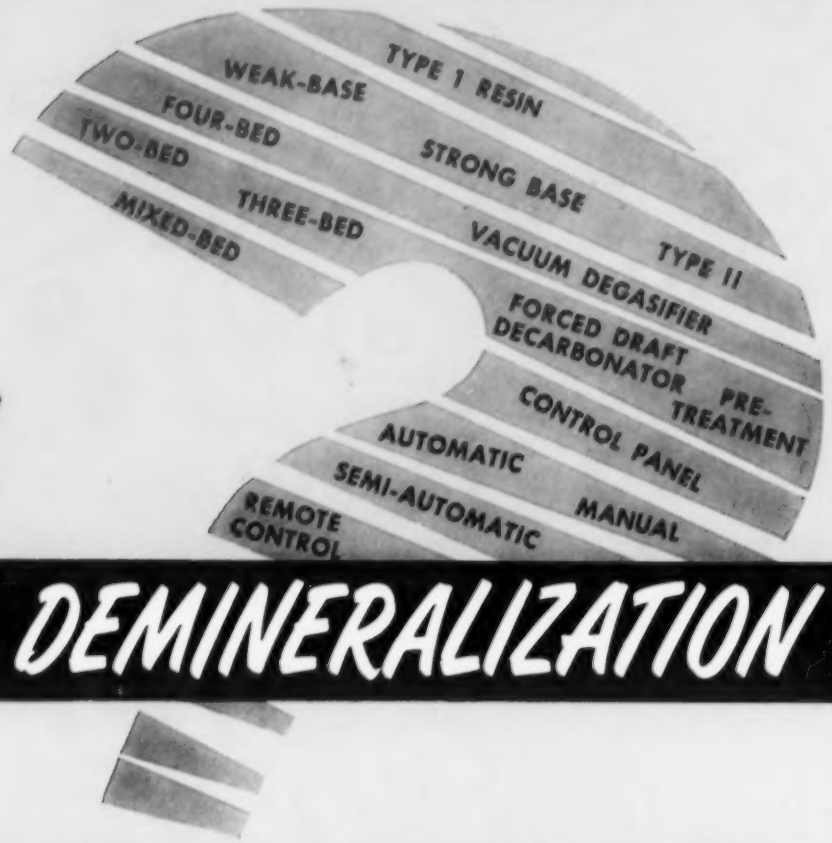
PROFESSIONAL RECOGNITION

NO SHORT CUT TO GLORY

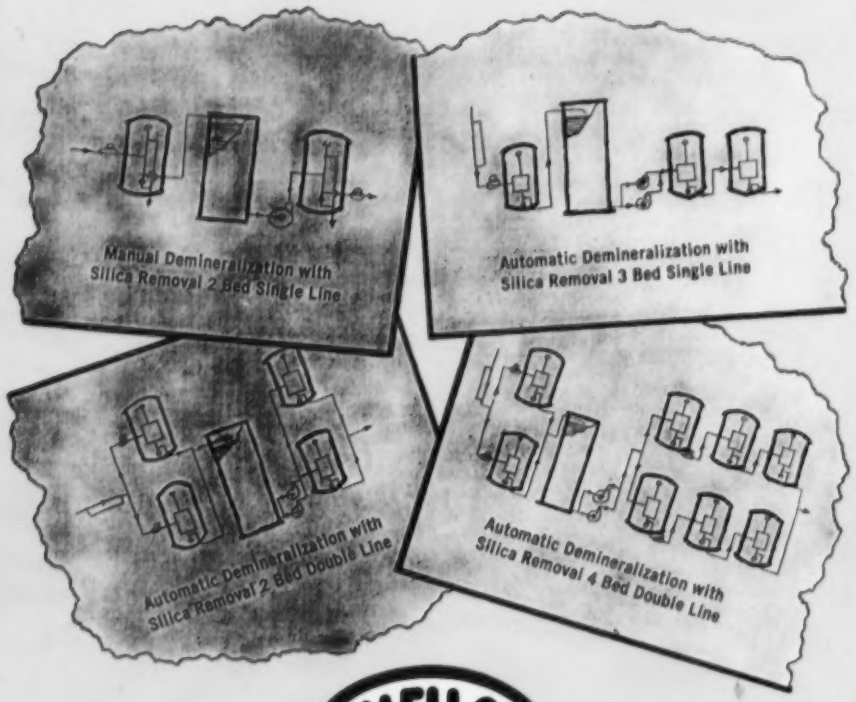


KENNETH A. ROE
EXECUTIVE VICE PRESIDENT
BURNS and ROE, INC.

WHAT'S YOUR PROBLEM in DEMINERALIZATION



INFILCO demineralizers are custom-built to solve the specific problems of each power plant


Manual Demineralization with Silica Removal 2 Bed Single Line
Automatic Demineralization with Silica Removal 3 Bed Single Line
Automatic Demineralization with Silica Removal 2 Bed Double Line
Automatic Demineralization with Silica Removal 4 Bed Double Line

The one best design for equipment to demineralize boiler feed water make-up depends on the characteristics of the water to be treated, boiler pressure and design, quantity of make-up required and many other variables peculiar to each installation. The best solution for one plant may be a manually operated two-bed demineralizer; in other cases three-bed, four-bed or mixed-bed demineralizers – manual or automatic – may be indicated.

INFILCO furnished the *first* demineralization and silica removal equipment for treatment of high pressure boiler feed water make-up. Since that time, we have cooperated with Consulting Engineers in finding the best combinations of equipment and ion exchange resins for a wide variety of central station and industrial power plant requirements.

Let INFILCO help you realize the most kilowatts per dollar invested in demineralization. For more information see your Consulting Engineer or write for Bulletin 1960C-IP-19.

Inquiries are also invited on all other water and waste treating problems including coagulation, precipitation, sedimentation, filtration, flotation, ion exchange and biological processes.

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late news

. . . about industry power

• Edison and McGraw merge

Thomas A. Edison, Inc. and McGraw Electric Co. have formally merged under the name of McGraw-Edison Co. to become one of the largest firms in the electric industry. Negotiations were first started back in 1928 but were shelved until recently. A five-fold expansion of research and development programs is planned on behalf of all 23 divisions of the new company.

• Advise gas turbines to firm up hydro

Utilization of thermal generating plants to "firm up" hydroelectric stations was advised at the Winter General Meeting of the AIEE by Vernon W. Ruskin of the B. C. Engineering Co., Ltd., Vancouver. He told a power generation symposium that thermal plants are economically feasible at hydro plants where studies show that periodic water shortages can be expected. Otherwise the hydro plant must be engineered to carry the anticipated firm peak and energy loads even under adverse water conditions. "Regardless of fuel costs, where gas turbine plants can be built at an appreciably lower first cost, they are more economical than steam plants for 'firm up' service."

• Fluorescents at 840 cps cut costs

R. D. Burnham, the Wakefield Co., told the AIEE Winter General Meeting session that 840-cps fluorescent lighting was installed in a small industrial office building with lower initial cost, increased efficiency, greater flexibility, and 20% power consumption reduction over a comparable 60-cps system. Air-conditioning load was reduced 10%. If lamp life proves to be longer, it will further reduce operating costs.

• Probe why engineers unionize

Engineering unions now claim as members nearly 60,000 of the nation's 500,000 engineers, according to a study just completed by the National Industrial Conference Board. While these figures show that engineers are far from being unionized, they do indicate possible dissatisfaction among engineers. NICB's study tried to determine why unionism has occurred among a group considered by many as "unorganizable." Findings show that many engineers are not completely happy with their financial position, their status as professionals, and their treatment as individuals.

One major financial complaint from engineers, study reveals, is that the earnings differential between salaried engineers and

(more late news on page 8)

Industry Power

FORUM

No short cut to glory

KENNETH A. ROE, Executive Vice President
Burns and Roe, Inc.

with H. A. Bergen, Editor

About Kenneth A. Roe

Kenneth A. Roe is a graduate of Columbia University in economics and chemistry, has a degree in chemical engineering from Massachusetts Institute of Technology, and a masters degree in mechanical engineering from the University of Pennsylvania. He is a licensed Professional Engineer in California, Connecticut, Indiana, Michigan, and Pennsylvania. He is a member of ASME, AIChE, American Chemical Society, Electro-Chemical Society, and the Technical Association of the Pulp and Paper Industry.

He has been associated with Burns and Roe since 1940, except for naval service from 1941 to 1945 as officer in charge of turret and other ship construction work at the Philadelphia Naval Shipyard. Experience as mechanical engineer with Burns and Roe includes estimating, design, and construction of steam and hydro-electric generating plants and jet engine testing laboratories, plus project engineering on high-temperature metallurgical programs.

Roe has supervised reports and studies on the development of hydro power for the State of Parana, Brazil and for the Corporacion Venezolana de Fomento, Venezuela. He was executive administrative engineer at Burns and Roe from 1951 to 1953 . . . . responsible for planning and control of administration activities on all projects and contracts . . . . including supervision of project engineers, scheduling, budgeting, and purchasing-expediting.

Since 1954, he has been executive vice president, functioning as the chief operating officer of the company responsible for the administration of all company operations.

IN AN AGE of spectacular engineering achievement, there is some feeling that the engineer does not get as much public esteem as do his colleagues in other professions. He is a professional man, just as the doctor and the lawyer. But there is some doubt that the engineer's recognition matches his accomplishments.

Why does the engineer lack adequate prestige? Perhaps because his contribution to everyday life and his part in raising the standard of living are not widely publicized. Other professions have raised their standing in the community and nation through extensive publicity campaigns. Many engineers feel as doctors feel . . . . that they have a moral obligation not to publicize themselves. We might point out, however, that the doctor is dealing intimately with human beings. Every case the doctor handles is actually a public relations job. His work by its very nature might be called "self-publicizing."

We are not intimating that the sociological import of the engineer's achievements always matches that of the doctor or scientist. However, the engineer's accomplishments are equally as difficult and require the same long years of patient searching and testing before success is achieved.

Although a professional engineering license means a lot to the man who has it, the general public is probably unaware of its significance. Partly responsible is the lack of similarity of licensing requirements for engineering in the 48 states. A definite program to establish reciprocity in licensing should receive the fullest cooperation and support of all engineers interested in raising the community status of themselves and their profession.

The engineer's apparent reluctance to participate in community affairs may contribute to his lack of professional acceptance in his locality. Often, he is missing from the school board, political groups, and planning commissions where other professional men are asked to give their time and effort. His unique talents could be especially helpful. The unfortunate part of this situation is that such activity could aid not only the community-at-large but also the individual status of the engineer as well as his profession.

Closely related may be the engineer's often meager support of his professional societies. Too small a percentage of engineers join an engineering society. Many who join do not actively support it. Meetings are often poorly attended. Too few engineers join a committee or otherwise help to strengthen and activate the membership.

There is no short-cut to glory. Proper recognition for the engineer will not come overnight. However, there is much the individual and companies can do to elevate the profession. Public recognition rests on the engineer's status in the company he works for. His company can:

- Encourage all qualified men to get their PE license.
- Acknowledge the significance of the PE license when promotions are made and when technical responsibilities are established.
- Supply sufficient clerical help to engineers so they may work at their professional level free of nonengineering detail.
- Send key men to schools for advanced education.
- Reassign men from time to time to round out their backgrounds.
- Support engineer's participation in professional societies . . . . especially in committee work and writing papers.

Through planned and concerted efforts of companies, individual engineers, and engineering societies the engineer can attain and maintain his rightful status in the community-at-large in relation to his truly significant achievements. ♦♦

Unretouched photo shows what happens when a boiler feed line is clogged with calcium carbonate deposits. CAUSE: *lack of chemical stability in feed water.* REMEDY: *properly balanced water treatment.*

LINE OF MOST RESISTANCE

A heavy build-up of scale, like that shown in the illustration, will gradually reduce the effective diameter of feed line piping, and will result in seriously restricted carrying capacity.

The line must be shut down for maintenance or replacement, causing expensive down time in the plant. Proper water conditioning will prevent this unnecessary loss. This is but one of the many problems presented by the corrosive elements of water.

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Industry Power

FOR MEN WHO MANAGE POWER SERVICES

VOLUME 72 NO. 2 FEBRUARY 1957

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Vast quantities of water and air are required for testing jet engines. Here, from Lewis Flight Propulsion Laboratories, is a fine example of agile engineering that is providing maximum economy.

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Speed and accuracy in network analysis can be yours for the asking, simply by renting an analyzer. The most usual questions about what an analyzer can do for you are answered by an expert.

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You can save money by using weather-protected motors if you understand their advantages and limitations. This engineering and economic appraisal will help you make the best use of what's available.

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Severe scaling was raising havoc with boiler tubes at Mutual & United Insurance Companies of Omaha. Both heating and air conditioning suffered until a new treatment was used.

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given:

—to add nitric acid to liquid isotope at 4500 psi.

—to pulse liquid extraction columns — 4½ gal. per stroke, 100 strokes per min.

—to pump liquid oxygen at minus 340°F.

—to flow-blend inhibitors in high pressure process lines.

—to charge pressurized-water atomic power systems.

—to pump additions of D_2O to new homogeneous reactors.

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nuclear news

. . . about industry power

INVITE THIRD ROUND

Lewis L. Strauss, AEC Chairman, announces that the third round of proposals from industry under the Power Demonstration Reactor Program is now invited . . . . removing all limitations upon sizes and types of nuclear plants to be considered and requiring only that the proposed projects promise a significant contribution for achieving cheap, abundant, and safe nuclear power. Priority will be given to a reactor fueled with natural uranium and using heavy water as moderator and to a fluid-fuel reactor system.

SIX SCHOOLS TRAIN REACTOR SPECIALISTS

Six institutions of higher learning are cooperating with the AEC's Nuclear Reactor Specialists Training Program to meet growing personnel demands by government and private industry. Courses are getting underway at the University of California (Los Angeles), Carnegie Tech, Case Institute, Northwestern University, Florida University, and Union College. Each will conduct a six-month course on unclassified material, to be followed by six months study at Oak Ridge.

NEGOTIATE FOR FOUR SMALL REACTORS

AEC announces that negotiations are progressing for varying forms of assistance in the AEC's Power Demonstration Reactor Program to bring resources other than those of the federal government into developing reactor technology and to advance the time when nuclear power reactors will become economically competitive. Programs under negotiation are

. . . . a closed-cycle boiling-water reactor rated 22,000 electric kw

. . . . an aqueous-homogenous reactor rated 5000 to 10,000 electric kw

. . . . a heavy-water-moderated sodium-cooled reactor rated 10,000 electric kw

. . . . An organic moderated plant of 12,500 electric kw.

PREDICT ATOMIC SPACE HEATING

Factories, office buildings, and other large structures may be heated atomically within a few decades "without a speck of soot, an ounce

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"CORDON" CIRCUIT BREAKERS

Widely accepted for high fault protection on low voltage applications

...4 frame sizes available for immediate delivery

Conceived and engineered at I-T-E. Recognizing the need for a practical and economical means to adequately protect low-voltage distribution circuits where very high fault currents are encountered, I-T-E engineers conceived and developed the first completely integrated current-limiting molded case circuit breaker. Named the "Cordon", this compact circuit breaker has an interrupting rating of 100,000 rms amperes.

Manufactured and tested by I-T-E. The "Cordon" combines all the design and operating advantages of standard I-T-E molded case circuit breakers with the proven high interrupting ability of current limiting Amp-Traps.* A prototype of this was developed, tested and retested until it met the rigid I-T-E standards. Then, and only then, was a complete line offered to industry. Four frame sizes are now available.

*Amp-Trap: T.M. Reg. The Chase-Shawmut Co.

Widespread acceptance. Now thousands of delivered "Cordon" circuit breakers prove industries' acceptance of this device and confirm I-T-E's belief in the need for it. More and more "Cordon" circuit breakers are being specified as the practical, economical answer for low voltage, high fault applications.

Learn more about this new concept in circuit protection. Contact the I-T-E sales office nearest you, or write for Bulletin 5042A.

I-T-E CIRCUIT BREAKER COMPANY • Small Air Circuit Breaker Division

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225 amp CK frame
400 amp CKL frame
600 amp CL frame
100 amp CF frame
Engineers are now specifying these I-T-E Current-Limiting "Cordon" Circuit Breakers.
Immediate delivery can be made on all four frame sizes, for 600 v a-c and 250 v d-c service, 15 to 600 amperes.
I-T-E

of ash, or a cubic foot of smog." According to a General Electric engineer, successful use of reactor waste heat at Hanford, Wash. atomic plant shows that dirt-free atomic heating is technically feasible. Design of a low-energy heat production reactor and overall reductions in costs of building and operating such reactors will determine when atomic heating will become practical.

GREAT BRITAIN SEEKING LEADERSHIP

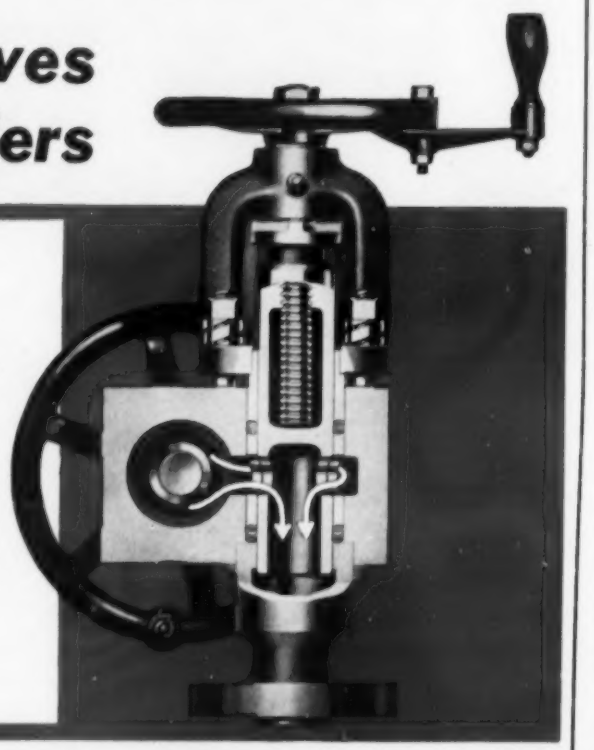
Small, easily transportable, nuclear power plants may soon be generating electricity in remote mining areas and serving as atomic work horses for scores of other industrial uses in the less-developed countries . . . . if the announced intentions of Hawker Siddeley Nuclear Power Company come to pass. Without spelling out details of the company's work on a liquid-metal-fuel reactor, the firm's bid for leadership in nuclear power is based on "noteable progress in its development of advanced reactors for electric generation."

NEW REACTORS MAKE NEWS

Visitors to the International Atomic Exposition and 1957 Nuclear Congress next March 11 to 15 will be able to walk around and inspect a critical nuclear reactor in actual operation in Philadelphia's Convention Hall . . . . Italy's largest power company will buy a 134,000-kw atomic power plant from Westinghouse . . . . Babcock & Wilcox will be granted a license to export a pool-type research reactor to Brazil . . . . An experimental reactor facility supplementing current work in the boiling water reactor program will be built by AEC at the National Reactor Testing station in Idaho . . . . Notice has been given that a permit will be issued through AMF Atomics to build a pool-type research reactor in Plainsboro Township, N. J. for Industrial Reactor Laboratories, Inc. ♦♦

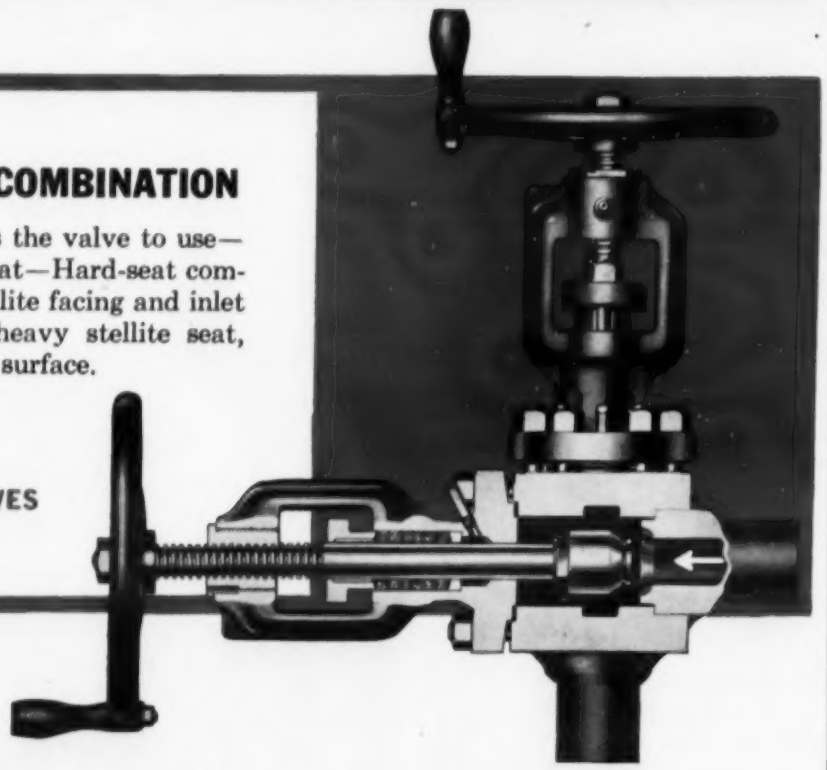
UNIT TANDEM

rugged blow-off valves for high pressure boilers



HARD-SEAT—SEATLESS COMBINATION

■ For boilers up to 1500 psi, this Yarway Unit Tandem Blow-Off Valve offers the maximum in dependable service. A one-piece forged steel block serves as the common body for the Yarway Stellite Hard-seat blowing valve and the Yarway Seatless sealing valve. All interconnecting flanges, bolts and gaskets are eliminated. The Unit Tandem at right is sectioned through Seatless Valve to show balanced sliding plunger in open position and free flow.



HARD-SEAT—HARD-SEAT COMBINATION

■ For boilers to 2500 psi, this is the valve to use—Yarway's Unit Tandem Hard-seat—Hard-seat combination. Disc has welded-in stellite facing and inlet nozzle has integral welded-in heavy stellite seat, providing smooth, hard-wearing surface.

OVER 4 OUT OF 5
HIGH PRESSURE PLANTS
USE YARWAY BLOW-OFF VALVES

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YARWAY BLOW-OFF VALVES

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late news

. . . starts on page 2

hourly workers has become too narrow in many companies. And in terms of fringe benefits, engineers claim that their former advantage over production workers has been virtually wiped out. As professionals, engineers want better communication with management to clarify their understanding of company policies; credit in reports and papers they help develop; classification as professionals rather than grouping with non-professionals; and less frequent assignments to jobs requiring little engineering ability. Disappearance of the personal relationship that once existed between engineer and employer is largely responsible for the dissatisfaction engineers now feel as individuals. Engineers object to being treated on a mass basis in hiring, training, and other employment situations.

• Largest hoists ever ordered for new mine

Westinghouse Electric Corp. is to supply electrical equipment for two mine hoists at Anaconda Co.'s Ryan Shaft in Butte, Montana, which is to be sunk later this year. Each hoist installation will include two 3000-hp, 600-volt dc motors operating at 500 rpm and capable of operating at 200% frequently applied load and 225% occasionally applied load. Two 3000-hp motors on each hoist will be powered by a 5000-kw, 600-volt, 514-rpm mg set. Two 2500-kw generators are driven by a 7000-hp, 2300-volt synchronous motor with 250% pull-out torque. Synchronous motor is energized by full-voltage air break drawout-type switch-gear. Hoist will operate from four hoisting levels, shallowest being 1636 feet and deepest being 4720 feet below the shaft collar. A 26,000-pound skip will haul a pay load of 36,000 pounds at a maximum speed of 2846 fpm so that total cycle time including skip loading time will be less than two minutes from 4720-foot level.

• GE ships new gas-filled transformer

Revolutionary new power transformer—insulated and cooled by gas instead of oil—was shipped recently from General Electric's Power Transformer Department. Unit, rated 2000 kva, is designed to take electric power from transmission lines at 69,000 volts and step it down to 480 volts. It is the first of two identical units for Consolidated Edison Company of New York City. Gas is sulfur-hexafluoride, a compound of sulfur and fluorine that is stable, nontoxic, and nonflammable. Gas is sealed in the transformer at a pressure of 30 psi and is forced through the transformer's magnetic steel core and copper coils. ♦♦

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see page 53

that's interesting

. . . for industry power

Recommend energized insulator washing

Tests show energized insulator washing is a safe, economical method of removing most contaminants from power station insulators and apparatus bushings, thereby eliminating flashovers, according to what J. M. Mabe of Central Power & Light Co. told the AIEE Winter General Meeting. Energized washing means cleaning the insulators when they are hot, without turning off the power. From 1925 to 1942 cleaning was done by de-energizing the insulator and wiping with a wet rag. First attempts at energized cleaning by trying to create artificial rain over the insulator proved unsuccessful because of flashover. In 1950 a test was run to determine leakage currents that could be encountered in washing equipment energized at 40 kv, line-to-ground. An adjustable Elkhart 1½-inch Mystery nozzle with tap water at 55 psi was set up 20 feet from the insulator. Leakage current through water stream was checked as nozzle was moved closer to insulator by connecting a milliammeter in a lead from nozzle to ground. Test was discontinued at a distance of four feet between nozzle and energized insulator. No leakage current was detected. Resistance of tap water used was 650 ohms/cu in. To prevent electric shock, man handling nozzle had to stand on a metal plate with nozzle tied to plate and plate tied to ground.

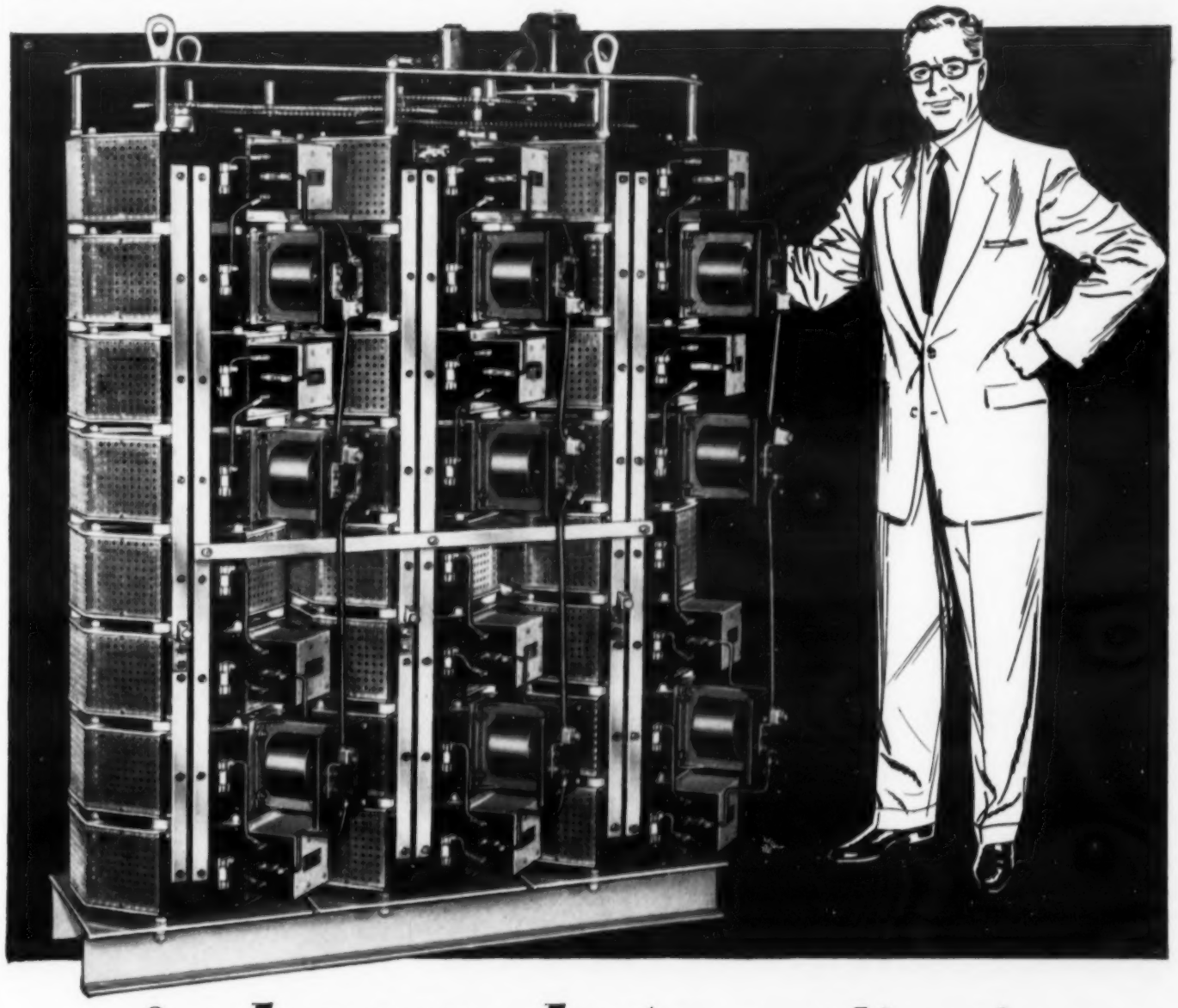
Indicates turbine rotor clearance

An electronic instrument that continuously measures clearance between rotating and stationary blades inside a steam turbine has been developed by the National Bureau of Standards. Detecting element is a mutual-inductance micrometer probe in printed circuit form on a ceramic base that resists high-temperature steam erosion inside the turbine. Rotor position indicator, designed by the Navy Bureau of Ships, will aid in the study of steam turbines under operating conditions.

Metallic whiskers stretch for research

Highly pure and perfect metal crystals known as "whiskers" are enabling scientists at Westinghouse Research Laboratories to gain new insight into the enormous forces that bind atoms together. Tiny metal strands may be 40 millionths of an inch or less in diameter — about one hundredth the thickness of a human hair. An ordinary piece of metal contains countless millions of structural imperfections which, under stress, govern how and when it will break. By conducting tensile tests on whiskers, individual atoms can be pulled far enough apart, without breaking, to measure the interatomic forces. Only a small force — less than one hundredth of an ounce — is required to pull the average whisker apart. Force is obtained from a lightweight pendulum about 12 feet long. Whisker is clamped between pendulum bob and a special takeup screw. As this screw is tightened, whisker pulls the pendulum from its vertical position, exerting more force on the whisker. An optical system is used to measure the stretch. Experiments have proved that, freed of the limitation imposed by impurities and imperfections, interatomic forces give iron a strength of more than half a million psi.

POWERSTAT® Variable Transformers



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As the leader in its field, The Superior Electric Company offers the widest selection of variable a-c voltage control apparatus. Standard POWERSTATS are available in ratings from 150 to 160,000 volt-amperes. For heavy duty requirements, POWERSTATS in gangs of 6, 8, 9, 12, 15, 18 or more provide the same fast accurate adjustments to fractions of a volt as the smallest rated unit. Generally, heavy duty POWERSTATS are motor-driven for effortless control from remote "raise-lower" switches or positioner stations. Standard heavy duty POWERSTATS are supplied for single or three phase; 120, 240 or 480 volt service with current ratings up to 400 amperes.

For more information on POWERSTATS for heavy duty applications, use the coupon below.

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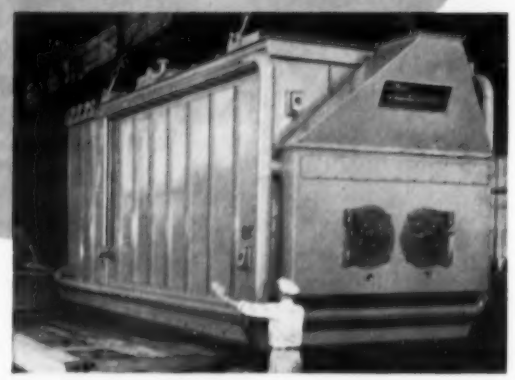

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VOLUME 72 NO. 2 FEBRUARY 1957

A Publication of
PUTMAN PUBLISHING COMPANY
also publishers of CHEMICAL PROCESSING, FOOD PROCESSING, and FOOD BUSINESS
111 E. Delaware Place, Chicago 11, Ill.
Cleveland — Detroit — Los Angeles — New York — Pittsburgh
Portland — San Francisco — St. Joseph, Mich. — St. Louis

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this month's comment . . . .

big month for engineers . . . . so what?

FEBRUARY IS A BIG MONTH for engineering to dramatize its place in the world as a profession. Eleven months of the year, engineers go about their business with no thoughts of glory. But this month, February, these national events focus attention on engineers:

• National Engineers' Week, February 17 to 23, founded in 1951 by the National Society of Professional Engineers. This year the week is sponsored in NSPE's behalf by 11 big engineering names . . . . including Dr. Vannevar Bush, Charles F. Kettering, Philip Sporn, David B. Steinman, and Robert E. Wilson. This year's theme is "Engineering — America's Great Resource." Because George Washington was the country's first engineer, National Engineers' Week is always set to span his birthday.

• National Science Youth Day, February 11, founded in 1957 by the Edison Institute on the 110th anniversary of Thomas A. Edison's birth. Activities are planned to teach high school youth about modern careers in science and engineering. Charles Kettering is president of the Edison Institute. Walker Cisler is chairman of the National Edison Birthday Celebration.

• National Electrical Week, February 10 to 16, sponsored by some 12 industry organizations through a National Electrical Week Committee. Object of the Week, first held in 1956, is to focus attention on the contributions of electricity to our American way of life and on the contributions toward the economic strength of our country of the organizations which make up the electrical industry.

Now, we believe that all of these activities are steps in the right direction. That they are relatively new activities points out that our awakening to the fact that we are a profession capable of cohesion is recent. That these activities are but steps means that the great burden for advancing engineering as a profession rests not on short bursts of intense activity by high-caliber engineering guns . . . . but on sustained long term activity by we who make up the greater bulk of the profession.

February is, then, a big month for engineers. But each February can be bigger than the last if we use the other eleven months to build our profession up to the level of glory it truly deserves. How can we do this? We commend to your attention the remarks of Mr. Kenneth A. Roe on page 3 of this issue.

Harold A. Bergen
Editor

Pulsating neoprene panels inside the bin are PneuBin's secret weapon against bin flow bottlenecks. The PneuBin unit consists of steelbacked, neoprene, pulsating panels mounted on the inside wall of your present bins . . . and air controls to regulate the panels' action. By the pneumatic inflation and deflation of the PenuBin panels, the bin contents are positively displaced to insure free flow. After the panels have deflated, the air control unit (operating off the regular plant air supply) starts another cycle of inflation and deflation. The process continues *automatically* at whatever frequency is set on the air controller (this frequency is adjustable).

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Send for "Flow Stoppage Report" and free literature. PneuBin engineers will gladly make recommendations, with no obligation on your part.

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MAY CORPORATION
OWINGS MILLS, MARYLAND

MANUFACTURERS OF —

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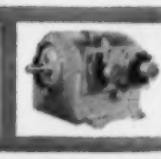
Variable Speed Hydraulic Transmissions

PneuBin—Pneumatic Bin Evacuators

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Jet engine testing points the way to . . . .

Better water treating and air handling for your plant

E. DANIEL WILLIAMS
Facilities Engineering Division
Lewis Flight Propulsion Laboratory

with R. W. De Moss,
Assistant Editor

ADROIT BEHIND-THE-SCENES engineering by the Facilities Engineering Division of Lewis Flight Propulsion Laboratory makes possible the vast quantities of water and air needed to test tomorrow's jet engines. Up to 32,000 gpm of water are recirculated and up to 286,000 cfm of air are compressed, refrigerated, and consumed.

Air requirements for turbojet engines have risen over the last decade from 35 lb/sec to 150 lb/sec. Thrust delivered has risen correspondingly from 1500 pounds to more than 9000 pounds. Operating temperatures, also, have increased markedly.

high-performance tests tax facilities

These performance increases, however, tax greatly the power services required for the complex testing process of new engine designs. Sea-level tests and even inflight tests give only a fraction of the information needed to evaluate performance. Required data can be obtained only by simulating a wide range of inflight conditions. These conditions include very low air pressures (less than 1 psia), extremely dry and cold atmosphere, and tremendous engine air needs in high-speed flight at 50,000 feet and above.

One major problem in testing jet engines at simulated altitude is disposing of hot exhaust gases. Since less-than-sea-level pressure must be maintained in the test cell, exhaust gases cannot be vented through an open-ended chamber. Gases must be pumped out of the cell at a rate matching the extremely large air volume being pumped into the cell for combustion. Exhaust gases, discharged from the engine at 3500 F or more, must be cooled to about 120 F to protect piping, valves, and exhaust equipment . . . . and to reduce gas volume handled.

For this and similar cooling purposes, a vast soft water recirculating system forms an integral part of the test facilities. Recirculating system does three important cooling jobs:

- Cools exhaust gases from engines in test cells;
- Refrigerates and dries combustion air fed to test cells; and
- Removes heat in intercoolers and aftercoolers in the combustion air supply, lubrication equipment, and motors.

Primary function is to cool exhaust gases. Since exhaust gases are extremely hot, immediate problem is to protect the 14-foot dia test cell from intense heat. This is done by circulating water through an external jacket around the exhaust end of the cell. Exhaust gases at 3500 F are cooled in two stages to a temperature at which they can be safely handled by exhaust compressors. In the first stage, gases pass through a water-jacketed, water-tube primary cooler that reduces gas temperature from 3500 to 600 F.

After leaving the primary cooler, the 600 F gases flow through a header into a fire-tube secondary cooler that reduces gas temperature from 600 to 120 F. This secondary cooler is at the entrance to the long 13-foot dia compressor exhaust duct. Cooled exhaust gases then pass through four successive compressor stages that raise gases to sufficient pressure for final atmospheric venting. Soft water is used also for cooling in gas intercoolers between compressor stages in the exhaust system. This removes heat of compression and helps reduce gas volume handled.

water used in compressed-air system

Water also has a vital use in refrigerating and drying compressed air that is pumped at 45 psig into engine test cells for combustion tests. Air passes upward through two parallel vertical tanks and over cascade trays that provide contact with the liquid coolant. First air-cooling stage uses soft cooling-tower water to cool air from 120 to 90 F. Second air-cooling stage

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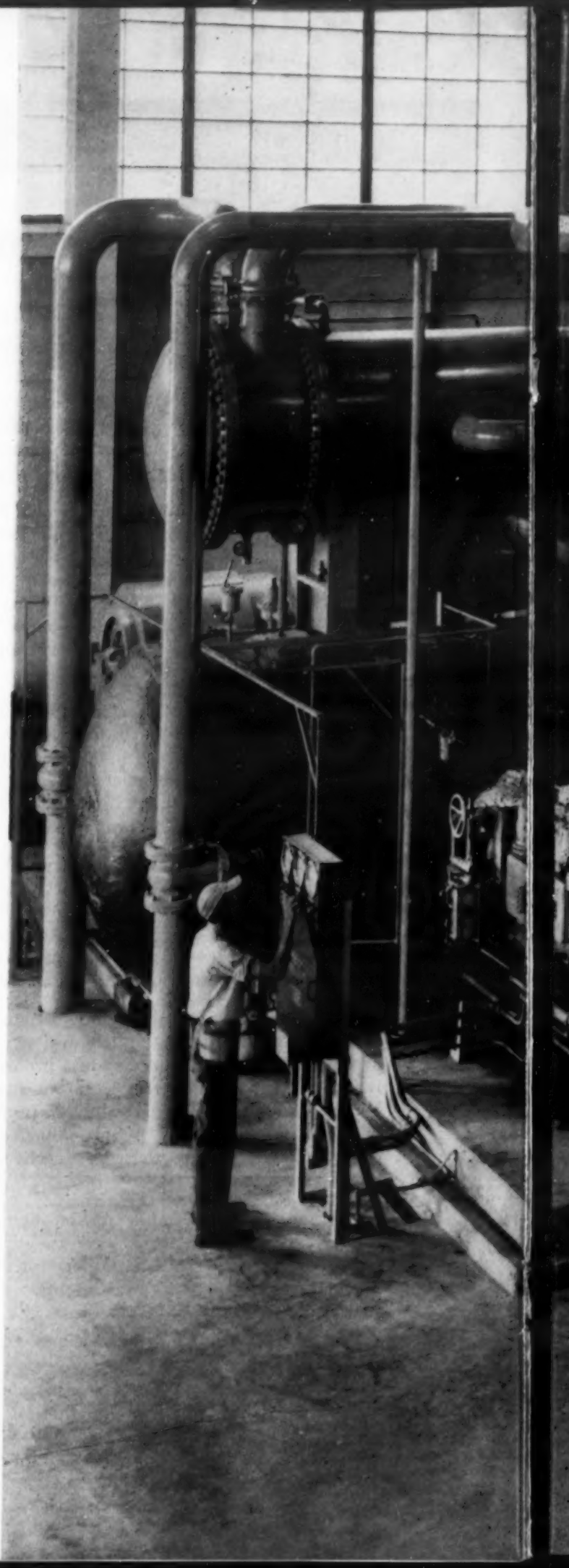
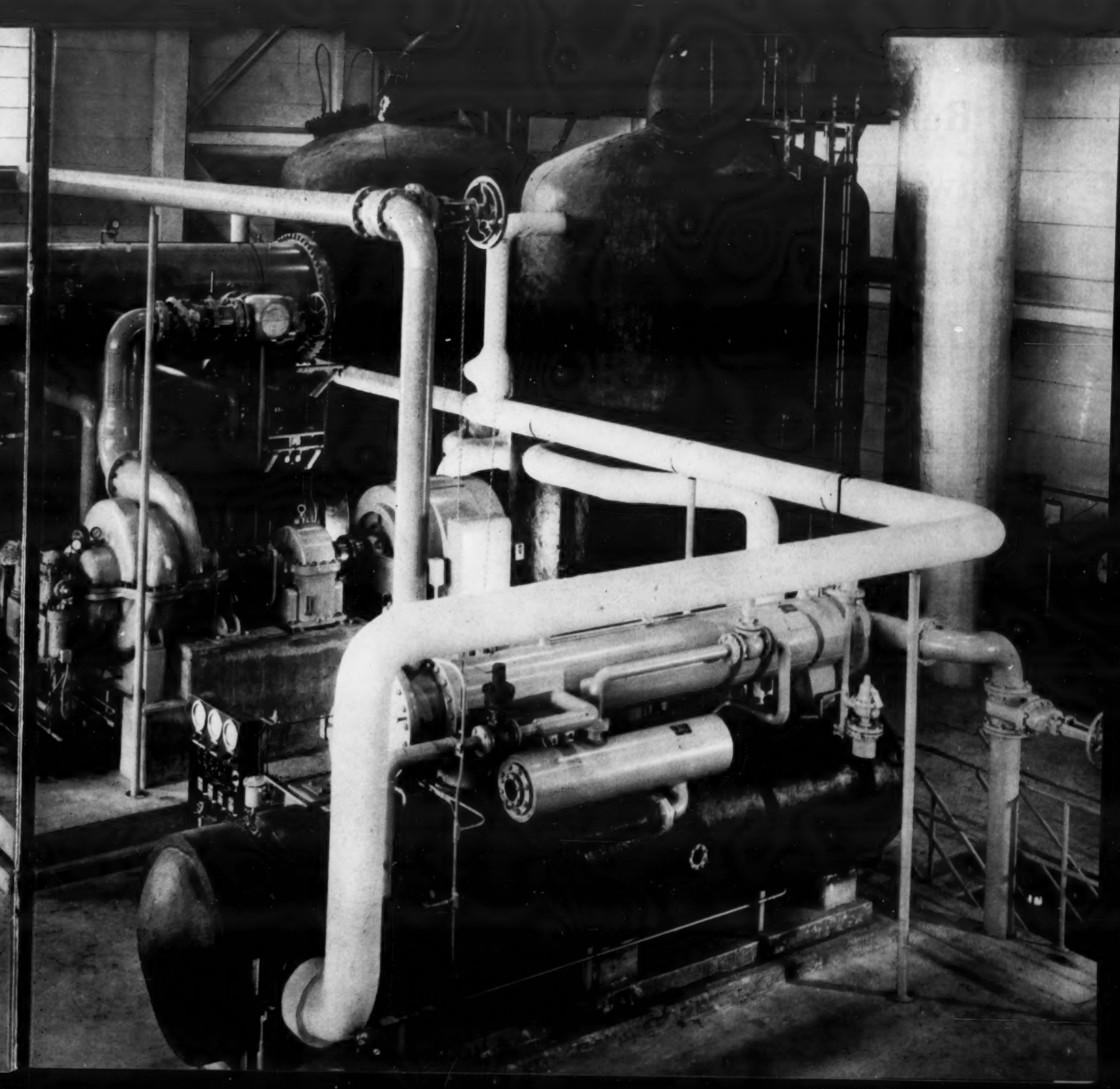


Refrigeration and heat-transfer equipment cools and dries air to simulate conditions at high altitudes.



Rent *speed* and *accuracy*....

Network Analyzers for Industrial Systems

JOHN I. YKEMA
Engineer-in-charge Analyzer Operation
I-T-E Circuit Breaker Co.

As interviewed by
Harold A. Bergen, Editor

Q: WHY SHOULD any industrial plant electrical engineer consider network analyzers for studying his distribution systems?

A: Computers for quickly answering all kinds of intricate problems have become commonplace. In the form of network analyzers, they have been used regularly for solving problems in connection with public utility and big industrial plant systems. Recently, however, it has become apparent that network analyzers can be used profitably for electrical distribution studies of moderate-size industrial systems . . . . or even small ones. Although many problems concerned with relatively small systems lend themselves to longhand calculations, modern analyzers give speedy and accurate solutions at negligible cost.

Q: What types of industrial electric distribution system problems are best suited to analyzer study?

A: Well, here is a list of problems where analyzers can be used to advantage:

LOAD-FLOW PROBLEMS

- Continuous current ratings of transformers, cables, breakers, switches, and so forth.
- Voltage variations due to abnormal operating conditions.
- Voltage dips due to motor starting.
- Effectiveness of power-factor improvement.
- Best transformer taps.
- Effect of outages.

SHORT-CIRCUIT PROBLEMS

- Voltage dips due to faults.
- Breaker momentary ratings.
- Breaker interrupting ratings.
- Effect of motors on fault current.
- Effect of bus sectionalizing arrangement.
- Effect of current-limiting reactors.
- Relay and fuse coordination.

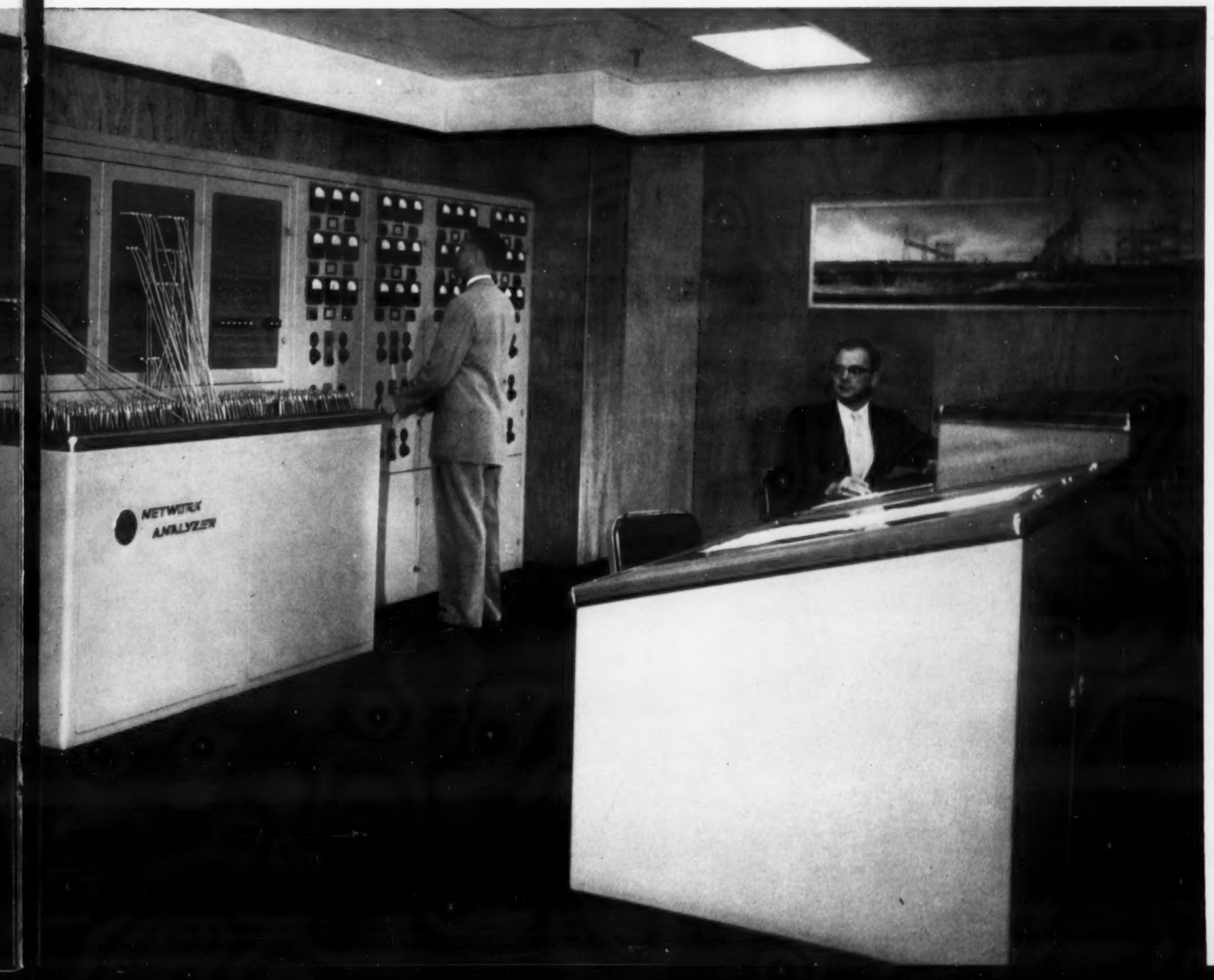
Well-lighted, sound-proof analyzer center provides ideal working conditions for engineering personnel.

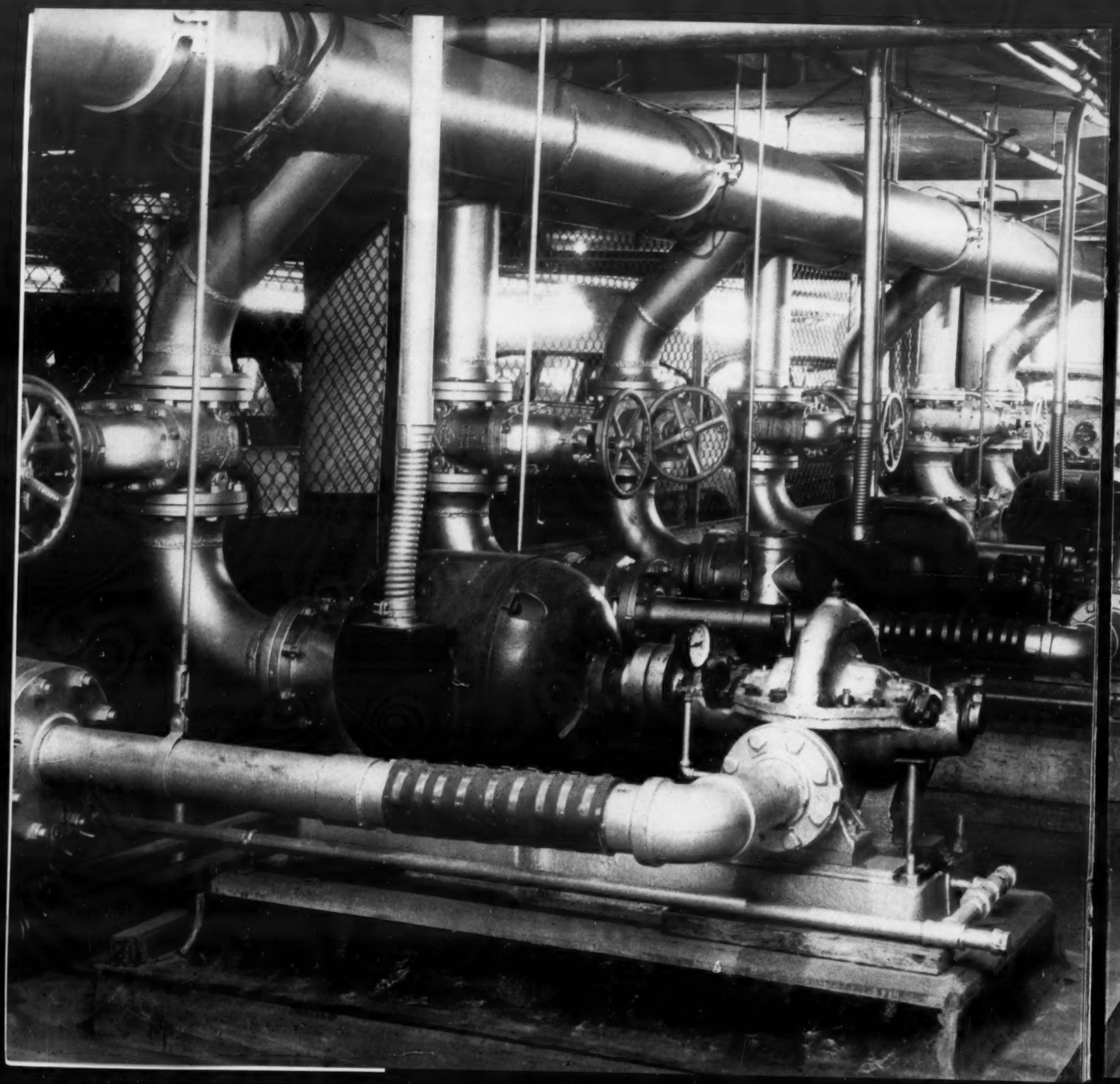
Q: But few industrial plants can afford to buy a portion of any network analyzer facilities. How can they get to use such equipment?

A: Analyzers, such as this one you are visiting today, are available for rental on a daily basis. In many instances, one or two days' time is sufficient to provide answers to both existing and anticipated future problems. The miniature of your system as represented on a network analyzer can provide you with many plans for improving your system that you never could anticipate otherwise. When you see how much data can be obtained quickly you will realize why we suggest investigating analyzer rental for studying your system.

You see, there is no guesswork in any study made on a network analyzer. Every contributing component of the system is precisely represented . . . . from power sources through all utilization elements. In our analyzer here, the right-hand section is used for representing incoming lines or generating sta-

(continues on page 42)





Worthington engineers cure disturbances
from a Kansas City pump installation
by using a step-by-step method to . . . .

LICK PUMP VIBRATION

DANIEL NOBLES and JOHN R. HAMILL
Research Engineer District Manager
Worthington Corporation

with Donald Hartley,
Managing Editor

HOW WOULD YOU determine the path through which vibration is transmitted from a pump room to building floors above? This was the problem facing Worthington Corporation engineers when called to the Dwight Building in Kansas City. Step-by-step elimination is the answer.

J. A. Bruening Company, owner of four office buildings, had bought four pumps to circulate cooling water through package air conditioners and cooling towers. All four pumps in the Dwight Building operate at 3600 rpm. Each pump and motor unit weighs about 3450 pounds. Pumps are manifolded so that any combination can be run automatically according to water demand.

Excessive noise in the offices above the pump room seemed to be caused by vibration transmitted from pumps to office floors and walls by the piping, building structure, or some combination of both. Airborne noise from pumps to offices was considered a relatively minor portion of the disturbance. In an attempt to isolate the vibration, units 1 and 2 were mounted on cork bases. Pump and motor of each unit were solidly mounted on a concrete base 60 by 30 by 14 inches, which in turn was supported on a 2-inch thick cork slab. Also, rubber hose sections were installed in the 4-inch and 3-inch suction and discharge lines of all four pumps. These measures helped, but the noise was still unsatisfactory in the office above. This office was panelled with hardwood, but it contained a wall-to-wall carpet and the ceiling had acoustic tile. It was not reverberant to any substantial degree, therefore.

Next, 16 pipe hanger rods near the pumps were fitted with rubber vibration eliminator units and 4 were fitted with ½-inch rubber pads around the clamp. This change had a negligible effect on the office noise.

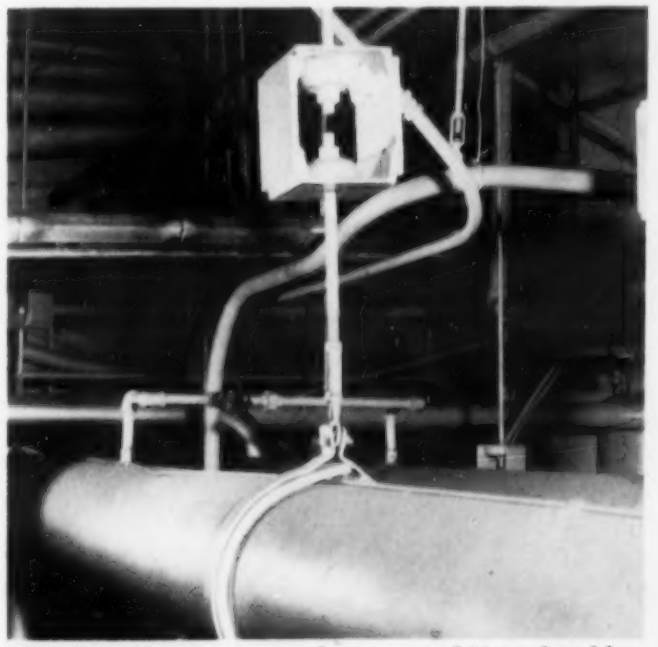
A tight-fitting box of ¾-inch plywood, lined with sound absorbing tile, was then built and assembled around one of the two cork-mounted units. Although pump room noise was definitely lower, there was no change in the office noise.

vibration tests were conducted

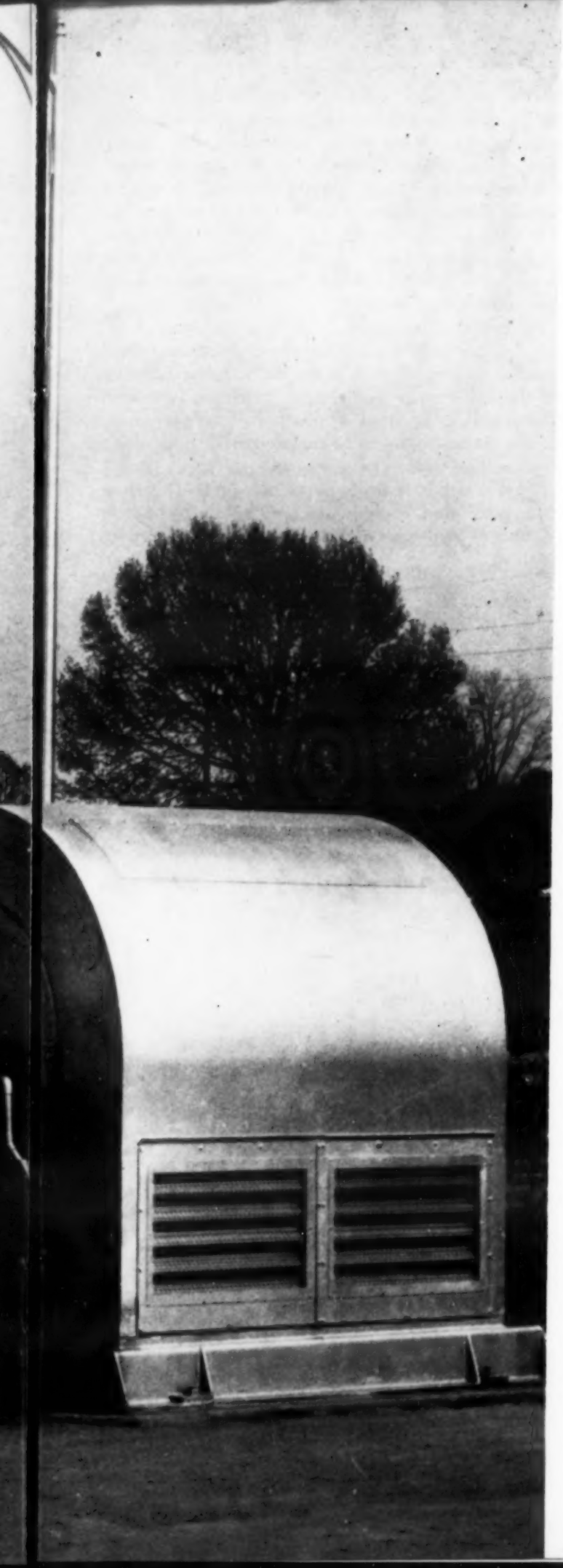
Surface vibrational velocity measurements were made because the vibration was resulting in audible radiated sounds. These measurements were made on motor and pump bearings, concrete base and adjacent floor, piping at both ends of rubber hose sections, pipe hanger rods on both sides of rubber vibration eliminators, and walls of office above. This procedure previously had given good correlation with measurements of the sound radiating from such vibrating surfaces. Vibrational amplitude measurements are not adequate for such a survey because a

(continues on page 44)

Two-inch layer of cork and four neoprene isomode pads underlie each concrete foundation block.



Vibration eliminator pipe hangers and ½-inch rubber pads inside clamps had little effect on vibration.



You may be spending money
for unnecessary motor enclosure protection.
Be sure to investigate. . . .

Why not WEATHER-PROTECTED motors?

R. L. NAILEN
Motor Engineering
Westinghouse Electric Corporation

with Robert W. De Moss
Assistant Editor

OUTDOOR, WEATHER-PROTECTED motors can save you from 5 to 15 percent in construction costs on your next job. In a typical power station, outdoor auxiliary motor capacity may total 12 percent of station generating capacity. Considerable misunderstanding exists concerning the exact protection afforded by motor enclosures. This misunderstanding costs money. It is aggravated by use of undefined terms.

With increasing use of induction motors in outdoor applications, weather-protected motors are gaining prominence. Major outdoor uses include irrigation, oil field, and pipeline pumping as well as powerhouse auxiliary drives. Two factors account for this increase of recent years: *First*, rapid growth of industry in the South and West. Climate in these regions is much milder than in the North and East. Some degree of weather protection is necessary, however, for a completely unshelterd motor. *Second*, skyrocketing construction costs have forced industry to move out-of-doors whenever possible. This is notable with steam generating plants, which are now often built completely in the open.

weather-protected motor advantages

Applications for the truly weatherproof motor are those in the open with no shelter except its own enclosure. Protecting such a machine from weather primarily means guarding against entry of splashing water or wind-driven rain or snow. Also, protection is involved against solid material—such as sand or dust—which might be carried into the motor by impinging air or water. Such foreign matter must be excluded regardless of the direction from which it approaches the motor. Also, birds and small animals must be prevented from entering into motor interior.

All this is necessary to prevent machine failure in either of two ways: *First*, there is electric failure. This results from insulation breakdown, which may be induced not only by moisture absorption but by erosion. (An interesting case is on record in which insulation in an open powerhouse motor was destroyed by cinders drawn into the motor with its ventilating air.) *Second*, there is mechanical failure. This may be caused by moisture that dilutes or washes away bearing lubricant, by dirt entering bearings, or by foreign objects becoming entangled in rotating parts.

weather-protected motors have limits

Weather protection must minimize possibility of these failures. It is no cure-all, however. There are certain things it will not do. External air is used to directly cool the motor. Any vapor contained in that air enters the motor. Weather protection is, therefore, not protection against corrosive gases or vapors. It is not protection against high humidity and insulation failure that can result. Nor is it protection against immersion or against obstructions that cut off the ventilating air supply.

National Electrical Manufacturers Association has recently defined a weather-protected motor in Standard MG1-1.13-H as follows: *A weather-protected machine is an open machine whose ventilating passages are so designed as to minimize the entrance of rain, snow, and airborne particles to the electric parts and whose ventilating openings are so constructed as to prevent passage of a cylindrical rod ¾ inch in diameter.*

Splashproof enclosures usually come close to satisfying this definition. According to NEMA, the splashproof motor is safe only against entry of solid particles that approach the motor at an angle of less than 100 degrees from vertical. Weather pro-

Weather-protected, 1500-hp, two-pole, squirrel-cage motor provides power for pipeline pumping station.

tection must evidently go further than this.

Some idea of how protection is provided is helpfull in deciding whether or not this type of motor enclosure is suited to a particular application. Good practice dictates including the following features in a weather-protected motor:

- BAFFLED OUTER ENCLOSURE. An overall outer shell encloses the motor frame and provides ducts for cooling air. All such ducts connecting the frame with outside atmosphere must have bends around which air will freely pass, but which will block foreign objects moving in straight lines. This is usually done by providing baffles within the outer shell. Entering air rises vertically for some distance on the outside of the baffle, then descends on the inner side into the motor. During this rise, relatively high-density entrained particles fall out of the air stream. Ideally, this rise would be so great that all suspended foreign matter would fall out before the air reached the top of the baffle. Baffles are made, therefore, as high as possible within practical enclosure limits (usually at least a foot).
- SCREENED VENTILATING OPENINGS. External openings must be screened, as indicated in NEMA definition, to exclude large objects. Design should permit installing air filters over openings in case of exceptionally dusty conditions.
- BLOW-THROUGH. Air passages should be arranged to allow high winds and driving rains to blow through the outer shell and *along* the baffles instead of being trapped *against* them. By providing maximum free air flow through the shell, cooling air velocity itself is minimized. This assists rapid fallout of foreign matter in the air. (Air velocity, rising vertically over the baffles, should not exceed 500 ft/min.) This also reduces headon splattering of air-water currents against the baffles, which tends to drive particles over the baffles and into the motor.

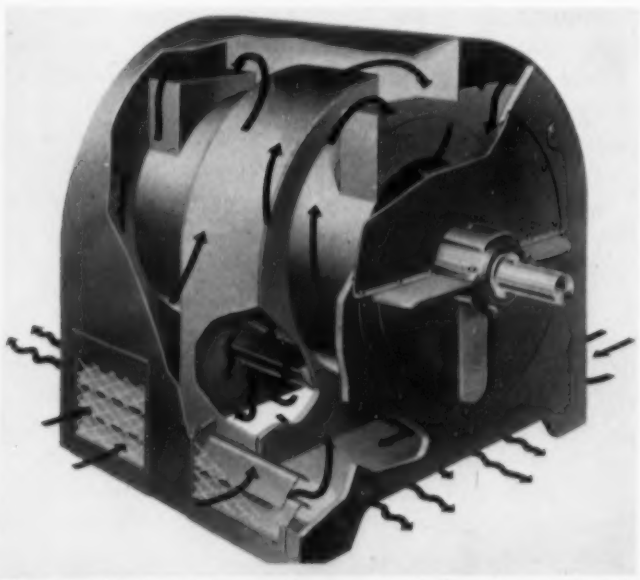


Fig. 1—Horizontal weather-protected motor is developed primarily for outdoor power plant installation.

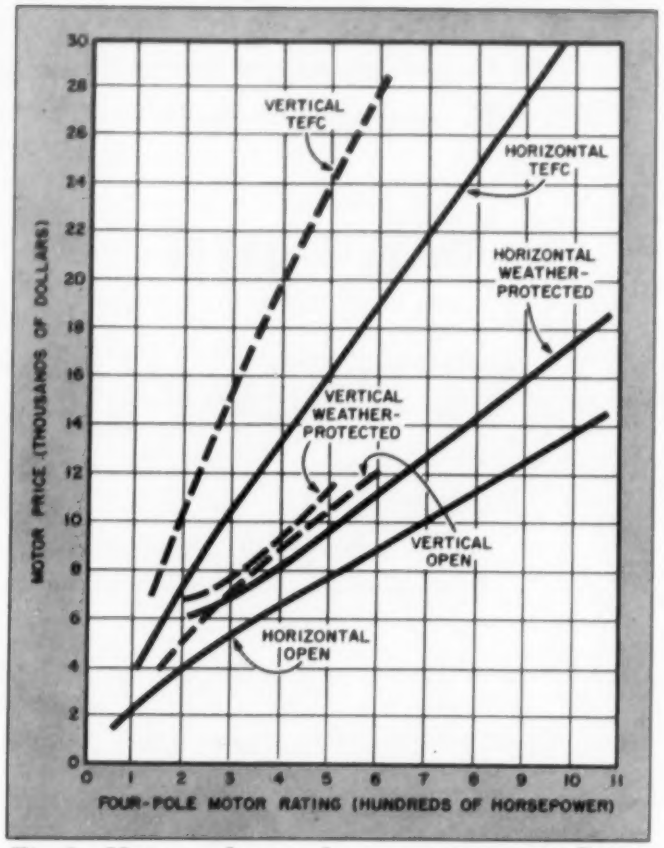


Fig. 2—Motor enclosure chart compares costs. Prices are plotted for four-pole, Class A insulated motors.

- SEPARATION OF INLET AND OUTLET AIR. Ventilating openings should be separated from each other as far as possible to prevent mixing inlet and outlet air. Internal duct work in the motor, likewise, must be arranged to minimize heat transfer between entering and leaving air.
- ADEQUATE VENTILATION. Last, but not least, sufficient air must be drawn through the motor to maintain safe operating temperature. (NEMA Standard MG1-2.11 allows a 50 C rise for weather-protected machines.) Air flow of at least 100 cu ft/min should be provided for each kilowatt of motor losses.

Ducting in a vertical machine enables it to retain the advantages of dual-end ventilation possessed by the horizontal machine, (Fig. 1) but results in a more complex enclosure than the horizontal machine.

price affects final decision

Once you decide that a weather-protected motor will give you needed protection from climatic conditions, you are then concerned with how much it will cost. You are likewise concerned with possible alternatives. If a weather-protected motor is not considered satisfactory, a totally enclosed motor is the usual substitute. We should, therefore, compare costs of these two types of machines. Typical prices for 4-pole, Class A insulated motors up to 1000 horsepower are shown in Fig. 2.

Pricing structure may, of course, vary with the manufacturer. Somewhere in the smaller motor sizes, there is a breakeven point. For motors below this breakeven rating, totally enclosed design is cheaper than weather-protected. This point is at about 150 horsepower (Fig. 2). Above this rating, a weather-protected motor will cost only about 3/5 as much as a totally enclosed fan-cooled machine of the same horsepower.

A second alternative is to use an open drip-proof motor with a weather-protecting shelter built around it. Cost of such a shelter may be justified by the lower price of the open machine (which is about 4/5 the cost of a weather-protected motor and ½ the cost of a totally enclosed motor). In many applications, however, adequate shelter sealing against weather requires extension of the building over associated equipment. Loss of the economic advantage in using outdoor plant construction may result.

consider maintenance costs

Maintenance schedules and reliability are also to be considered in making a selection. Since the weather-protected machine still uses outside air for cooling, 100-percent exclusion of moisture and dirt is impossible. Regular maintenance is required. This includes cleaning, lubrication, and replacement of air filters if used. Inspection and revarnishing of the winding may be necessary.

Maintenance required for the weather-protected motor is less than for an open machine. Presence of the baffled outer enclosure, however, makes the weather-protected machine still uses outside air for maintenance.

On the other hand, the totally enclosed motor needs only lubrication and occasional checks on bearing wear. Extensive experience of such users as the Consolidated Edison Company of New York has borne this out.

First saving of the weather-protected motor must be weighed against somewhat lower maintenance expense and inherently greater reliability of the totally enclosed motor. ♦ ♦

The Engineer of Tomorrow

"THE ENGINEER OF TOMORROW must be a man of broad education and deep culture, capable of leading his people beyond the frontiers of his day . . . . The real question which the engineers must answer, is whether or not we are meeting the problems of the community . . . . The job of attacking the world's frontiers, then, falls from the hands of the hunter, farmer, herdsman, or cowboy [to those of] the scientist and engineer".

. . . . Morris D. Hooven
Public Service Gas and Electric Co.

Rust, scale, and boiler tube failures were plaguing heating and air-conditioning facilities at Mutual & United Insurance Companies of Omaha. Then they found a . . . .

Simplified treatment *STOPS* boiler tube failure

C. L. GIER
Sup't of Mechanical Engineering
Mutual & United Insurance Companies of Omaha

with Robert W. De Moss
Assistant Editor

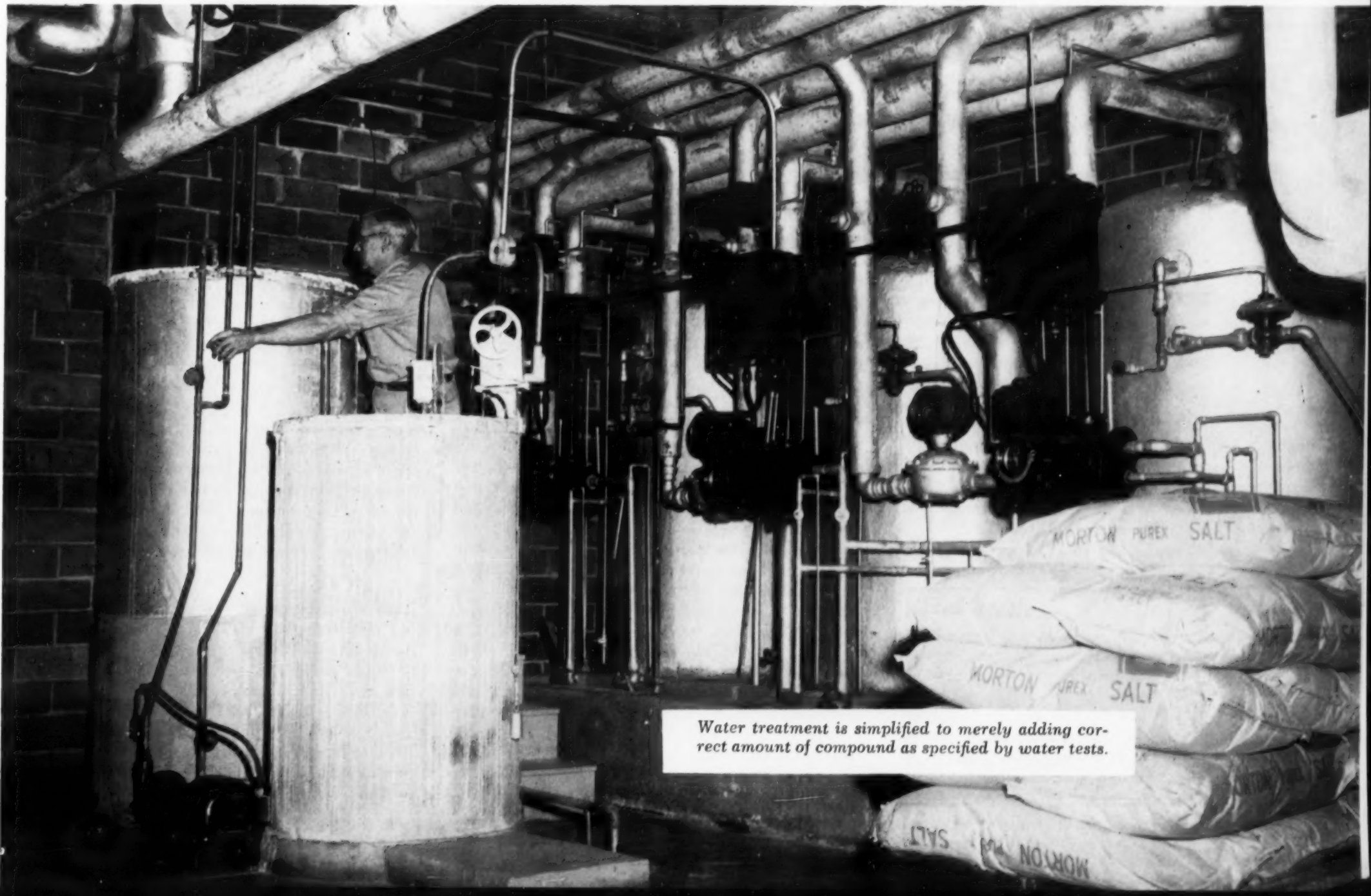
PROBLEM: How to treat 8¼ million gallons of water every 14 hours and prevent rust, scale deposition, and boiler tube failures. This was the problem facing C. L. Gier, superintendent of mechanical engineering, Mutual & United Insurance Companies of Omaha, Omaha, Nebr.

Chilled-water air conditioning and steam heating requirements for the 5,671,100-cu ft building and almost 2900 employees made dependable, trouble-free performance necessary.

Previous water treatment was unsatisfactory. Rust and corrosion were uncontrolled and scale deposits up to 1/32 inch were forming on condenser lines and in boiler tubes. Employee efficiency decreased as air-conditioning system efficiency decreased.

Raw water for use in the building comes from the city of Omaha municipal water system. Typical analysis of this raw water, which is obtained from

(continues on page 41)



Water treatment is simplified to merely adding correct amount of compound as specified by water tests.

POWER BASICS

FOR

TODAY'S INDUSTRY

Engineering Economics - - I

Looking through $-colored glasses

EUGENE S. FERGUSON
Associate Professor of Mechanical Engineering
Iowa State College

with Donald Hartley, Managing Editor

When it comes to deciding whether to buy a new car, an engineering economic study might help you compare costs. It can compare an investment—usually large—against expected maintenance savings —usually small. And the balance always comes out in favor of keeping the old jalopy for another year, or five years. So, if you want a new car, don't waste your time making an economic study. If your wife wants a new car, our advice is the same. Don't waste your time on an economic study because your wife won't believe your figures anyway. But buying new plant equipment is very different. The basic facts of engineering economics are not difficult. They are presented here in separate chapters and will be reprinted in inexpensive booklet form when the series is complete.

Eugene S. Ferguson received his B.S. Degree at Carnegie Institute of Technology and his M.S. Degree at Iowa State College. He spent several years before World War II with du Pont de Nemours in maintenance and construction engineering. After wartime service in the U.S. Navy, he started teaching at Iowa State College. He has been teaching since 1946, except for a year spent as plant engineer for Foote Mineral Company. Ferguson is a registered professional engineer in Iowa and in Pennsylvania. His technical field is heat power engineering. His particular terest in, and recognition of, the basic importance of power generation economics is responsible for this series on engineering economics.

ENGINEERING ECONOMY is a key to sound decision-making. Should we buy power or make it? Should we burn coal, or should we burn oil? We might install an underfeed or a spreader stoker, a mechanical-atomizing or a steam-atomizing oil burner. To decide which of several alternatives is best, we must first determine which one costs least, *in the long run.*

A few basic ideas of engineering economics, properly applied, will help us recommend to management the *best* solution to a problem that may have many *good* solutions. Our solution to the problem will then be as free as possible of guesses, hunches, preconceived notions, and prejudices.

You can prove anything with figures

Engineering economy will help you find the best possible solution to a problem that has two or more alternative solutions. Our purpose here is not to demonstrate how to arrange figures so they will prove what we want. Rather, our purpose is to show how to put down figures so that they will tell us what we are not likely to recognize intuitively.

Engineering economic principles can be applied to new equipment and new buildings, to replacement or modification of existing installations, and to the problem of when deferrable repairs should be made (when, for example, reblading a turbine will cost less than the increased operating cost with existing blading).

need systematic approach

Before deciding on specifications for a new installation, even tentatively, all possible alternative solutions to the problem must be explored and compared. Only then can we arrive at an intelligent decision. An open mind is a prerequisite.

To compare alternatives, we have to reduce them to terms that can be directly compared. The simplest terms are dollars. We won't worry yet about intangibles—items that cannot be reduced to dollars—even though they may be more important than dollars in the end. We will get the dollar story first, compare alternatives on a dollar basis, and determine which alternative is cheapest. Then, and only then, do we bring in the intangibles. They may change the picture completely, but we shall know how much our intangibles cost if we have already made dollar comparisons.

As a dividend for our efforts, it is quite possible that in casting about for all possible alternatives, we may arrive at an eventual solution that did not occur to us when we first attacked our problem.

When money is invested in new equipment, there are four annual costs that we can tabulate immediately. These costs—collectively called *fixed charges*—are incurred whether the equipment is used 8760 hours a year, or whether it is used only a few hours a year:

- First, we must pay *interest on the investment*

- Second, we must make *a depreciation allowance*
- Third, we must pay *property taxes*
- Fourth, we must pay *insurance premiums.*

We shall discuss how to calculate fixed charges later, but for now it is sufficient to recognize that fixed charges do exist.

EXAMPLE 1. Fixed Charges Are Omitted: A recent article in an engineering magazine mentioned that steam for an eastern processing plant was purchased from a neighboring boilerhouse at an annual cost of $17,500. This plant decided to install its own boilers. After a year's operation, these costs were reported:

Fuel oil cost: $6060

Labor, maintenance, insurance, gas, and electricity cost: $2400

Total annual cost: $8460.

Annual savings were claimed as $17,500 —$8460= $9040. Now, if the new boilers had been a gift and if no taxes were paid on the boilers, then the $9040 savings figure would have been legitimate. But first cost of the boilers was perhaps $40,000. For several years, at least, the annual savings of $9040 would be pure fiction.

Investment in new boilers probably was justified, judging by the figures given. To recover $40,000 cost of the boilers over a 15-year period while earning a return of 8% on the investment, annual fixed charges would total about $6700. Thus, stated operating savings of $9040 are not valid any more.

Fixed charges must be included in any valid economic study. Failure to do this may easily result in a questionable (if not dead-wrong) decision.

EXAMPLE 2. Fixed Charges Are Unreasonably Low: A municipal light plant, after installing diesel engines of 3000-kw capacity, reported a total power generating cost—fuel, labor, maintenance, depreciation, and interest on investment—of 5.9 mills/kwh based on an output of 15 million kwh/yr. Because the article from which these figures are taken suggested that industrial power plants could take a lesson from the municipal plant, we must look at the reasoning carefully to avoid jumping at a completely false conclusion.

First, fuel costs were low (probably about 2 mills/kwh) and load factor was not unfavorable (about 60%). Few industrial power plants are so fortunate. Second, property taxes were not included in costs because the municipal plant had no taxes to pay. Taxes would add another 2 mills/kwh to costs in an industrial plant.

You may say that it is still cheap power—but here is the gimmick. Where an industrial plant would require a return of 8 or 10% on its investment, this municipal plant is content with a return of 2.6% on its investment. An identical plant, owned by private industry and earning a reasonable return on investment, would show a total power cost of about 10 mills/kwh. As a general rule, municipal plants can show favorable results because their fixed charges are unrealistically low.

EXAMPLE 3. Time Value of Money Is Ignored: A consulting engineering firm recommended that a midwestern city buy a 12,650-kw generating unit rather than a 7500-kw unit in 1958—at an added cost of $348,000. A larger unit would, it was claimed, postpone the need for purchase of an additional unit by two years—from 1972 to 1974—and the resulting saving in fixed charges (during 1972 and 1973) would amount to $480,000.

A simple calculation shows that the $348,000, invested at 2½% interest in 1958 would amount to more than $480,000 by 1972. And 2½% is a pretty poor return on money needlessly invested, even for a municipality. This calculation was not included in the report, however, so readers were allowed to conclude that purchase of the larger unit would lead to savings of more than $100,000.

Our first two examples here demonstrate honest errors resulting from an incomplete understanding of engineering economic principles. Example 3, in the context of the report, only helps to confirm the suspicion that "you can prove anything with figures."

true purpose

Purpose of engineering economics is *not* to use figures to prove that a preconceived solution to a problem is the only correct one. Rather, its purpose is to use figures to determine which of several possible solutions costs least *in the long run.*

how to read and be right

To evaluate savings claimed by various writers (this one included) and to avoid errors in your own reasoning, there are available some well-established engineering economic principles. These ideas will be developed from scratch in subsequent articles:

- Time value of money
- Fixed charge rate (investment charges, mortgage premium)
- Effect of income taxes on capital expenditures
- Incremental return (added return for additional investment). ♦♦

Spend $348 and save $480

A municipal light plant has ordered a 12,650-kw generating unit, rather than a 7500-kw unit. According to a consulting engineering firm's report, the larger unit will postpone for two years the need for still another unit—from 1972 to 1974.

Here are the figures:

Additional first cost of 12,650-kw unit, compared to 7500 kw unit:	*$348,000*
Savings of fixed charges in years 1972 and 1973	*$480,000*

Readers are left to draw their own conclusions. What is wrong? The time value of money is ignored. If invested in 1958 at only 2½% interest, the $348,000 would be worth more than $480,000 by 1972.

Don't buy it, make it

A municipal light plant installed 3000 kw of dual-fuel diesel capacity, and then reported total generating costs of 5.9 mills/kwh . . . . including interest and depreciation. Here are the figures:

Total generation: 15,000,000 kwh/yr

	Mills/kwh	*Percent of initial investment (assumed at $2 00/kw)*
Fuel, labor, maintenance	*3.21*	
Depreciation	*1.65*	*4.1%*
Interest on investment	*1.04*	*2.6%*

Total fixed charge rate (interest plus depreciation) is thus 6.7%. This rate is higher than that used by many municipal utilities, but a reasonable rate for industrial power facilities would be 2½ times as high (16.7% for a return of 8% on investment). This rate would bring total costs to about 10 mills/kwh. Notice also that taxes are not included in the municipal plant's cost figures.

We'll make our own

Process steam, formerly purchased, is now generated in two new oil-fired boilers. Here are some recently published figures:

(Former) annual cost of purchased steam	*$17,500*
(Present) annual cost of fuel, labor, maintenance, supplies	*$8,460*
Annual savings	*$9,040*

What is missing? Fixed charges on the new boilers (investment charges plus depreciation, insurance, and taxes) have been omitted. Assuming a first cost of $40,000, an annual fixed charge that would earn a reasonable return (8% on the investment) would be nearly $7,000. Still a definite saving, but not nearly as spectacular as would appear at first glance. Figuring in depreciation and insurance charges reduce the savings still further.

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- Candy manufacturer doubled its plant production!
- Corrugating plant increased output of double-wall board 61%!
- Recovery plant eliminated the need for one of its two boilers!
- Chemical plant increased drying speed of drum dryer 44% with no wet spots, while increasing boiler capacity and saving $200 a month on fuel!

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new bulletins

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

400-Save with package firebox burners
Engineering specifications in Bulletin ID-56-215 cover package firebox boiler burner units for four-pass fire travel and for automatic operation with oil, gas, or oil-gas firing. Units save money on piping and bricking costs, stack costs, fuel costs, and floor space. Eight pages. YORK-SHIPLEY, INC.

401-Produce power with nuclear reactor
Aqueous homogeneous burner reactor for low and intermediate power range is described in Bulletin N-56-8. Includes basic reactor-plant flow diagram. Plant uses a one-region burner reactor as heat energy source. Four pages. FOSTER WHEELER CORP.

402-Package centrifugal pump guide
Ampco high-speed centrifugal pumps for handling clear liquids and fine slurries are made in type 316 stainless steel, Ampco metal, and Illium G. Bulletin P-3b-3c gives engineering and installation data on complete line. Six pages. AMPCO METAL, INC.

403-How to use gas sampling system
Catalog 56-1008-59 describes Hays Condu-Therm Analyzer and Acratron electronic recorder. Analyzer uses thermal conductivity method of analysis to determine amount of CO_2, H_2, He, CH_4, etc. Describes gas sampling systems in separate section. Twelve pages. THE HAYS CORP.

404-Test boiler, furnace exhaust gases
Product specification folder E65-5 describes Heat Prover combustion analyzer. Analyzer gives percent by volume of oxygen and combustibles present in exhaust gases from boilers and furnaces. Folder includes operating data and mechanical specifications. Four pages. BAILEY METER CO.

405-Air interrupter switches data
Bulletin 152 describes 3E line of air interrupter switches. Includes engineering and installation data for complete line. Schematic drawings give control mechanism details. Eighteen pages. ELECTRICAL ENGINEERS EQUIPMENT CO.

406-Pocket-size unit heater handbook
Engineering specifications, operating characteristics, installation and application data make Bulletin 9417 handy source of unit heater information. Data includes capacity tables, dimensions, external ductwork suggestions, mounting heights, piping diagrams, pipe sizes, sound ratings, and wiring diagrams. Typical selection problem is solved in step-by-step procedure. Sixty-four pages. AMERICAN BLOWER CORP.

407-How to select protective coatings
Results of two-years' research on rust prevention in areas of severe rust-producing conditions are given in Bulletin 256. Includes information on all types of protective coatings. Gives tips on selecting specific coatings for most metal surfaces. Thirty-two pages. RUST-OLEUM CORP.

408-Automatic excitation system data
Advantages and limitations of four basic types of automatic excitation systems are given in Bulletin 05R8530. Lists principal component parts used in each system. Eight pages. ALLIS-CHALMERS MANUFACTURING CO.

409-Combination motor starter guide
High-voltage combination starters for 2300- and 4800-volt squirrel-cage, wound-rotor, and synchronous motors give extra overload and short-circuit protection. Bulletin 2-850 describes new type FPA combination starters. Twelve pages. FEDERAL PACIFIC ELECTRIC CO.

410-Electric membranes demineralize
Bulletin 3 describes electric membrane plants in the million-gallon per-day range for demineralizing brackish waters. Performance data from plants using various feedwaters is included. Bulletin includes

". . . a power failure? Lady, you think you got troubles."

figures on installation costs for electric membrane plants in the mgd range, on costs in comparison with other demineralizing methods, and on costs in relation to cost of solids in feedwater. Twenty pages. IONICS INC.

411-Thermostat capacity charts

Tubular type Temp-Guard thermostats make or break electric circuit by responding to changes in temperature or electric load. Bulletin contains cross section drawings of thermostats, photographs of possible lead and terminal arrangements, plus size and capacity charts. Eight pages. THE FRANKLIN DALES CO.

412-Combustion instruments guide

Standardized line of combusion instruments and controls for most combustion installations is described in new catalog. Covers automatic draft control instruments and actuators; solenoid, diaphragm, and motor-operated valves; time switches; relays; and oil burner primary controls. GENERAL CONTROLS CO.

413-Shear pin sprockets off-the-shelf

Folder 2749 describes Link-Belt sprockets with shear pin protection now available from stock. Includes tables of stock sizes, torque ratings, hub dimensions, and keyseats. Four pages. LINK-BELT CO.

414-Revise abrasive wheel safety code

Changes in 1947 safety code for use, care, and protection of abrasive wheels are given in American Standards Association Bulletin B7-1-1956. Booklet format permits handy page arrangement with code regulation material in lefthand column, explanatory material in righthand column. Seventy-six pages. GRINDING WHEEL INSTITUTE.

415-How to buy package substations

Six package steel substation designs for industrial use are described in Bulletin SB1. Includes engineering data and structure foundation plans for substations. Twenty-eight pages. LINE MATERIAL CO.

416-Pocket-size steel data book

Revised edition of Ryerson steel data book gives useful information on machining and fabricating, specifications and tolerances, weights and dimensions, and safe loads. Aids in selecting kind, shape, and size of steel to meet all needs. Tables, definitions, and general data are included. 256 pages. JOSEPH T. RYERSON & SON, INC.

417-Pulverizer gives uniform fineness

Type MB planetary roll and table pulverizers give uniform fineness when pulverizing solid fuels. Bulletin MB-55-5 gives cross section drawings of pulverizer. Includes capacity tables and dimensions. Four pages. FOSTER WHEELER CORP.

(more new bulletins on page 26)

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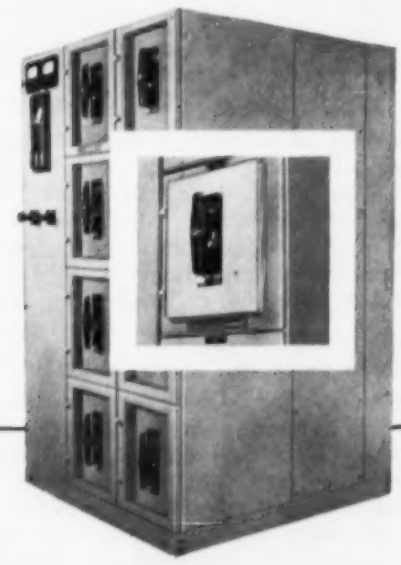
Only Allis-Chalmers low voltage switchgear permits convenient storing of breaker in its own compartment with door closed!

To give space needed when breaker is in disconnected position, center panel is reversed by simply loosening four knurled nuts. No tools are needed.

A specially contoured reversible center panel in each compartment door does the trick. When breaker is in test or completely disconnected position, the center panel may be reversed to extend outward from the surface of the unit . . . gives additional space inside cubicle.

This means no special storage space is required for breakers not in use. Handling and danger of damage during movement of breakers are eliminated.

As long as breaker is in compartment it is always firmly fastened to withdrawal mechanism and can't make contact accidentally.



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Circle 121 on READ-N-CIRCLE card for more data

new bulletins

. . . starts on page 24

418-Stop fuel line flashbacks

Bulletin SC-1006 describes operation and construction of Selas combustion safeguards. Automatic fire checks detect, localize, and extinguish flashback in supply lines. Safety blowouts prevent flashback and relieve excess flashback pressure in main supply piping. Twenty pages. SELAS CORP. OF AMERICA.

419-Measure, control liquids, gases

Bulletin 005 describes Simplex equipment for measuring and controlling liquids and gases. Includes technical information and engineering data on controllers, gages, manometers, recorders, meters, valves, and Venturi tubes. Forty pages. SIMPLEX VALVE & METER CO.

420-Varnished-cambric cable data

Bulletin VC-56 covers line of varnished-cambric cables for 600 to 5000 volts for single- and three-conductor cables, braided or lead sheathed. Engineering data section covers conductors and conduit; insulation thickness; armored cable racks and components; terminators for interlocked cable; electric circuit formulas. Twenty-four pages. ROCKBESTOS PRODUCTS CORP.

421-Acoustic materials reference

Acoustical Materials Association reference manual is a compilation of architectural acoustics and acoustical materials data. Covers nature and causes of sound, remedies for excessive noise, methods of acoustical analysis for sound-conditioning a given area, installation data on acoustical materials. Fifty-eight illustrations supplement text. ACOUSTICAL MATERIALS ASSO.

422-Metal saw blade handbook

Problem of selecting correct blade for any metal sawing job is simplified by handy charts in new handbook. Handbook covers selection and use of hand and power hacksaw blades. Recommends cutting speeds, feeds, and techniques. Covers common metal cutting problems and their solutions. Handbook is fully indexed. Thirty-six pages. W. O. BARNES CO., INC.

423-How to install armor cable

Installation of interlocked armor cable systems is pictured in pocket-size Booklet 19-606. Photographs show terminations and splices; switchgear connections; motors and plug-in bus; special installation problems; typical installations. Before-and-after pictures compare standard wiring system with interlocked armor cable system. Thirty-six pages. GENERAL ELECTRIC CO.

424-Boiler ratings in Btu/hr to steam

All manufacturers' organizations boiler code ratings in Bulletin DB-44-56 are reduced to common relationship of Btu/hr delivered to steam. Bulletin also gives useful tables and charts on flue gas volume for oil, gas, and coal. Selection, use, installation, and performance data on De Bothezat induced draft fans are also given. Twenty pages. DE BOTHEZAT FANS DIV., AMERICAN MACHINE AND METALS, INC. ♦ ♦

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RUBBER PRODUCTS
ALLFLEX HOSE Handles
Easier On Every Job!
Here's an all-purpose hose that's strong, yet light and kinkless . . . a versatile work-saver for handling air, water, oil and gases —even mild chemicals! It's the first hose of its type made for all-purpose use . . . offers a degree of strength *plus* flexibility not possible with ordinary all-purpose constructions. Allflex has no pre-set twist . . . coils and uncoils freely *in any direction* . . . has uniform inside and outside diameters for faster, easier, *safer* coupling.
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This entirely new, patented, power transmission drive features a *single, endless* parallel V-ribbed belt running on sheaves specially designed to mate precisely with the belt ribs. The results? *Uniform* belt pull, *even* distribution of drive load . . . highest horsepower capacity per inch of drive width. Gives you up to 50% more power than a conventional V-belt drive of equal width . . . or the *same* power in as little as ⅔ the space!

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Circle 108 on READ-N-CIRCLE card for more data

names make news

. . . personalities from industry power

American Gas Association confers Awards of Merit on **John H. Eiseman,** Gas Chemistry Section, and **Howard S. Bean,** chief of Capacity, Density, and Fluid Meters Section . . . . both of the National Bureau of Standards. Eiseman was recognized for his research on physical and chemical properties and utilization of fuel gases. Bean's contribution was on calibration of volume and capacity standards used in commerce and industry.

General Electric Co. announces retirement of **Everett S. Lee,** *General Electric Review* editor and former executive engineer of the General Electric Engineering Laboratory. Lee's 40-year engineering career includes such professional recognition as being elected president of AIEE, being elevated to Fellow in ASME and AIEE, and being chairman of Engineers' Council for Professional Development.

Adams

Bahr

AIEE awards 1956 Edison Medal to **Comfort A. Adams,** Harvard University professor emeritus and AIEE past president. Professor Adams was also the recipient of the AIEE Lamme Medal in 1940 and was the first recipient of the Miller Award for outstanding contributions to welding technology.

National Society of Professional Engineers names **John L. Bahr** committee chairman for National Engineers' Week February 17 to 23. Theme is "Engineering . . . . America's Great Resource." Bahr is chief engineer, National Vulcanized Fibre Co.

Westinghouse Electric Corp. appoints **Dr. Clarence Zener** director of its Research Laboratories. Since joining Westinghouse in 1951, Dr. Zener initiated a new theoretical approach to metallurgical research that resulted in a new metal, Nivco, for turbine blades.

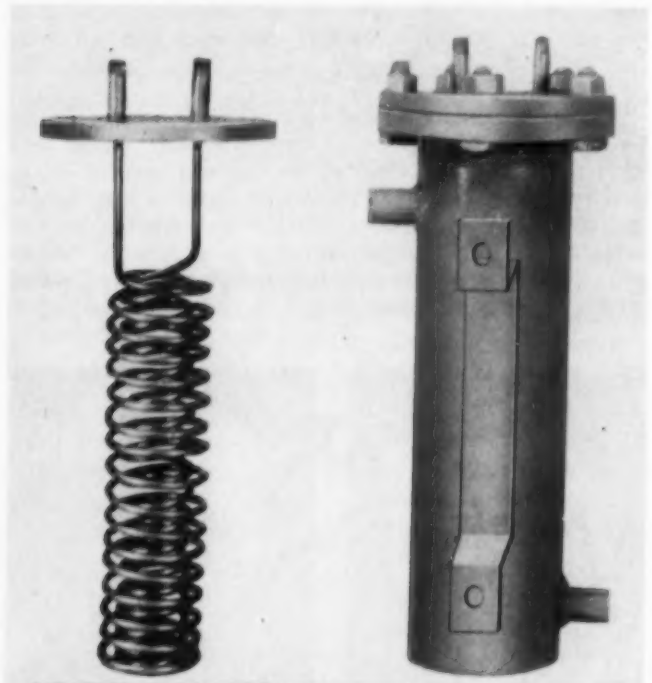
The Korfund Co., Inc. elects **Dr. Bela K. Erdoss** president. Dr. Erdoss is well known as a consulting engineer, research scientist, administrator and one time faculty member of Lehigh University. ♦ ♦

new products

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

700-Water sampler prevents flashing

Boiler water sampler prevents "flashing" when taking boiler water samples for analysis. Equipment is suitable



for boiler blowdown to 900 psig and 750 F. Cooling coil contains 30 feet of copper tubing. Unit can be installed on control panel in any position. REMPE CO.

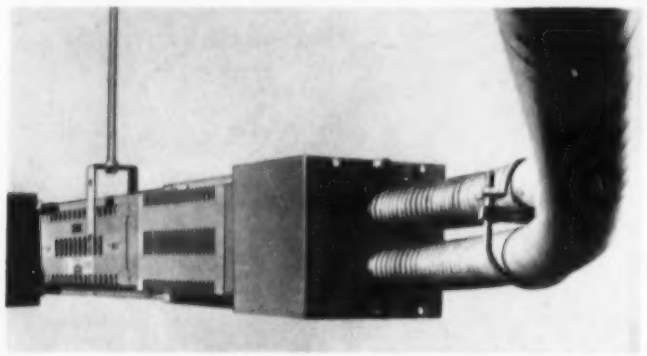
701-Taper-face flanges reduce costs

Taper-face, lightweight, welding-neck flanges offer technical and cost advantages where lighter schedule pipe must be connected to 125 pound cast iron valves and other equipment. Tapered face exerts greater pressure

near the bore. This eliminates problems in obtaining leakproof seal when conventional flanges with full-face gasket are used. Tapered flange will not overstress or crack cast iron or semisteel flanges when bolted together. Hydrostatic tests indicate that tapered flange joint will withstand three times the pressure it could contain if taper was omitted. New flange is rated at 125 pounds wog. Bolt circle and drilling are the same as for ASA 150 standard steel flanges. TUBE TURNS.

702-Plug-in bus offers low impedance

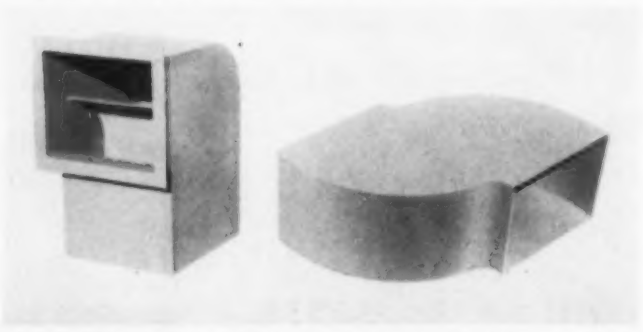
Power distribution bus system combines low-impedance characteristics and plug-in construction. Special plug-in units and interlocked covers provide maximum safety during installation and relocation. Bus bars are covered until plug-in devices are fastened to busway over plug-in opening. Interlocked contacts prevent current interruption — switch or breaker must open circuit



before contacts can be removed from bus bar and cover can be opened. Busways are available in copper or aluminum with single-run ratings of 225, 400, and 600 amperes in 2-, 3-, and 4-pole housings. Bus housings are identical for all ratings. WESTINGHOUSE ELECTRIC CORP.

703-Get corrosion-resistant fume ducts

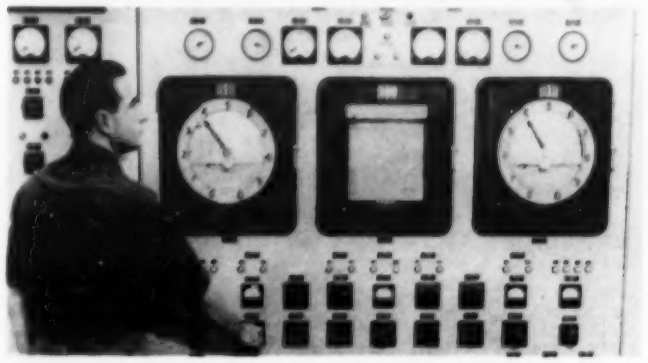
Corrosion-resistant plastic fume ducts and fume hoods are available in any configuration. Ducts and hoods are fabricated of thermo-setting plastic material combined with glass or other synthetic fibers. Combination of chemical resistance, light weight, strength, and easy workability make ducts suitable for many installa-



tions. Lightweight overhead ducting can be supported easily. Physical properties range from 11,000- to 15,000-psi tensile strength, and 22,000- to 30,000-psi flexural strength. THE CEILCOTE COMPANY, INC.

704-Monitor measures O_2 in flue gas

New flue gas monitor helps you attain peak combustion efficiency. System accurately and reliably analyzes 0_2 content to measure excess air. It can automatically adjust fuel-air ratio to maintain optimum combustion. Analyzer measures oxygen content by the unique



paramagnetic properties of oxygen. Analyzer compares flue gas 0_2 content to very stable 0_2 content of atmospheric air. Electronic recorder measures analyzer output signal and records 0_2 content directly in percent oxygen. Analyzer can detect change in flue gas oxygen at a sam-

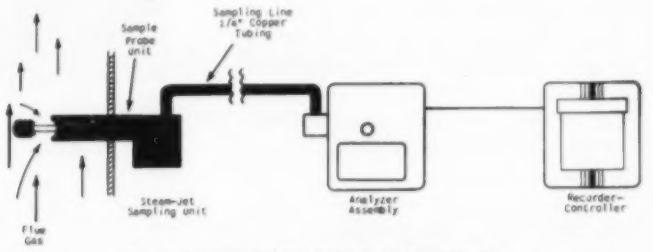


Fig. 1 Schematic diagram showing basic components of the L&N oxygen analyzer system for combustion control.

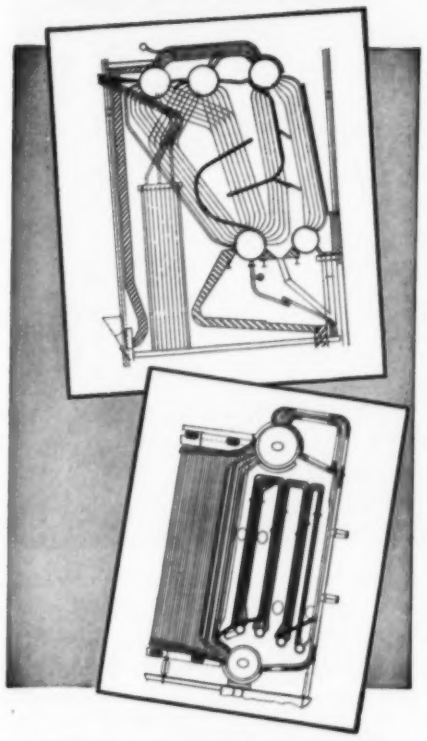
pling point 150 feet away within 13 seconds. Analyzer data checks average Orsat readings within 0.2%. LEEDS & NORTHRUP CO.

705-Lubricant banishes carbon deposit

Carbonized lubricating oil deposits at high-temperature operation are eliminated with this lubricant. Keystone No. 49 Light Oil resists oxidation, sludging, and breakdown when subjected to severe tests. Lubricant's low carbon content and antigumming features make it a superior lubricant for ring bearings in electric motors,

multiplate friction clutches, drying oven conveyor chains, and other high-temperature operations. Lubrication tests show excellent results in hot, cold, or contaminated atmospheres. KEYSTONE LUBRICATING CO.

ONLY ENCO BAFFLES *give you all these* COST CUTTING FEATURES



These important fuel-saving maintenance-reducing features are obtainable with Enco boiler baffles—*and only with Enco baffles.*

- **Streamlined gas flow**
- **Uniform gas flow**
- **Elimination of bottlenecks**
- **Reduced draft losses**
- **Higher heat transfer**
- **Cleaner heating surfaces**
- **Less use of soot blower**
- **Special provision for expansion**
- **Easy tube replacement**
- **Adaptable to any water-tube boiler, fired by any fuel**

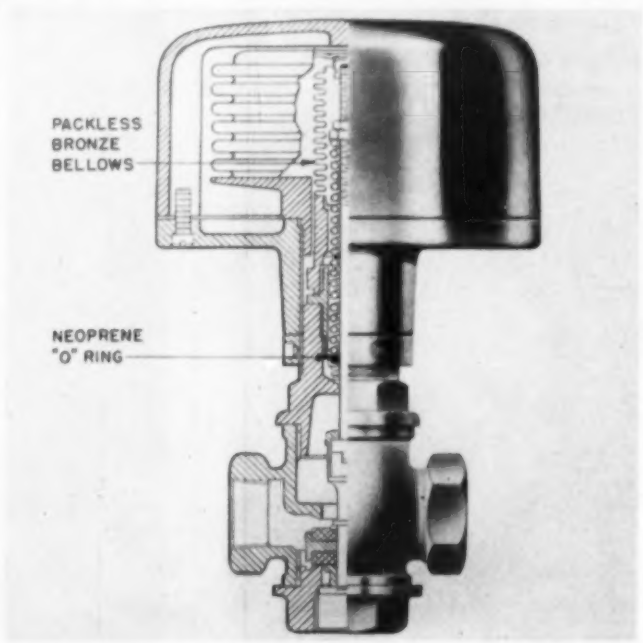
Each application is designed on the basis of more than a quarter century of experience in this specialized branch of power engineering. Installations are made by skilled mechanics.

THE ENGINEER CO.
75 WEST STREET, NEW YORK 6, N.Y.
In Canada: Rock Utilities Ltd., 80 Jean Talon St. W., Montreal, P. Q. ec-sos

Circle 125 on READ-N-CIRCLE card

706-Packless valves cut maintenance

Packless valves cut valve maintenance, reduce operating costs, and give more precise control. Instead of packing, valves use a bronze bellows as primary seal, and a spring-loaded Neoprene "O" ring as secondary seal. Bronze bellows eliminates leakage common to conventional packed valves and requires no maintenance. Between 10 and 15 years' useful life can be expected. Packless valve top is easily removed for replacing bronze bellows without draining system or removing valve from the line. THE POWERS REGULATOR CO.



MORE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 47 or 48.

707-Terminal lugs give snug fit

Low-price terminal lug has a circular boss that butts flush with insulation to give a snug fit and to permit easier taping. Provides up to 11% more contact area than cylindrical or hexagonal bodies. Serrations give higher resistance to horizontal pull. Made in seven sizes for all installations. PENN-UNION ELECTRIC CORP.

(more new products on page 30)

modern plant . . .
modern dust control

Kirk & Blum installed this modern, efficient system in a high production chair factory.

The Kirk & Blum C-3 Collector is mounted over a 3800 cu. ft. storage bin, capable of storing 10 days' collection.

For a survey of your needs, or for further details, write:

THE KIRK & BLUM MFG. CO.,
3174 FORRER STREET,
CINCINNATI 9, OHIO

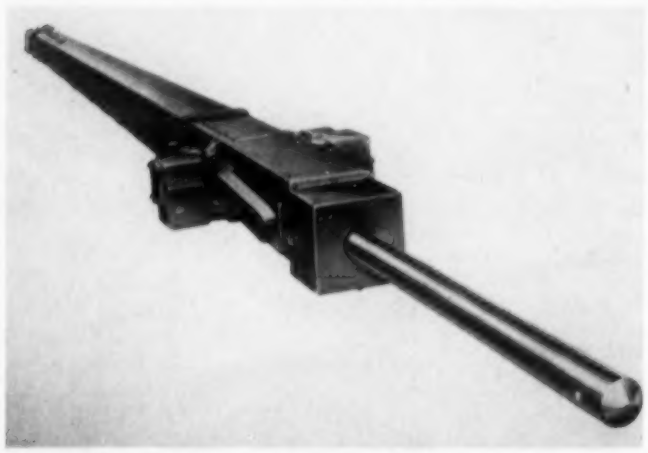
Circle 146 on READ-N-CIRCLE card for more data

new products

. . . starts on page 28

708-Sootblower travels 36 feet

Retractable sootblower is designed for very wide furnaces and travels more than 36 feet. Can be used with either air or steam, with nozzle pressures from 50 to 425 psig, without equipment change. Dynamic nozzle balancing prevents vibration and lance whip during operation.



Two electric motors control sootblower operation. One motor extends and retracts the lance and one rotates it for clean sweep around boiler interior. Stainless-steel sootblower feed pipe prevents binding and wear at operating temperatures to 750 F. Continually changing jet path minimizes tube cutting and eroding. Hardened steel scraper plate removes soot or slag particles as lance retracts. Scraper plate is adjacent to boiler wall for easy maintenance. COPES-VULCAN DIVISION, BLAW-KNOX CO.

709-Valve controls raw sewage influent

New, efficient, plug valve withstands severe service of valving raw sewage through disposal plant lines. Hycar rubber plug facing prevents strings, sand, metal chips, and other solids from scoring seating surfaces and causing leaks. Eccentric action swings plug back and away

from seat for maximum opening. Plug wedges tightly when closing and seals around intervening solids. Hycar facing has rigidity to close tightly, yet retains surface resiliency to prevent abrasion from solids. Hycar also resists chemical attack. DE ZURIK SHOWER CO.

710-Drills through reinforced concrete

Wet-type rotary drill eliminates time-consuming methods of drilling through reinforced concrete, marble, granite, and steel. Equipment plugs into standard 115- or

230-volt electric outlet for motive power. Self-sharpening bit is faced with specially selected industrial diamonds seated in high-test steel. Unit drills holes from 1 to 6 inches diameter at an average rate of 1 in./min. J. F. HAMLIN CO.

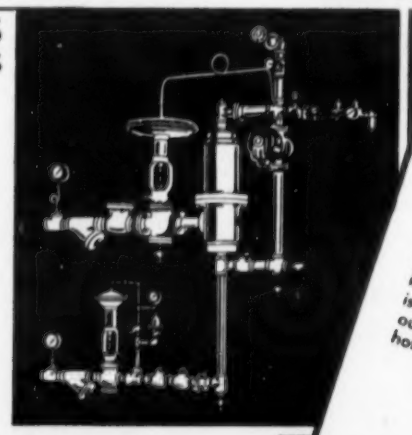
711-Makes exact copies in seconds

New photocopier is designed especially for small offices and departmental use. Small, compact, lightproof unit can be placed on typewriter stand or desk corner and will operate under any type of office light. Unit makes copies in seconds of any original up to 8½ inches

in width and any length. Ninety-five percent of all office copying can be made at a single dial setting. Slide-out tray allows developer to be changed quickly. COPEASE CORP.

Pick INSTANTANEOUS HOT WATER HEATERS

Pick STEAM INJECTION WATER HEATERS



ENGINEERED FOR SERVICE

Industries everywhere are replacing outmoded water heaters with Pick Instantaneous Water Heaters. Here are the reasons:

- HIGH OR LOW LOADS — Continuous or intermittent flow with negligible temperature fluctuation.
- WATER IS HEATED INSTANTLY. Entirely automatic, Water is heated in a flash to exact temperature by Steam Injection.
- FUEL SAVINGS ARE SUBSTANTIAL. No waste because water is heated only as used. Never stored and allowed to cool.
- NO STORAGE TANK REQUIRED. Compact design permits installations in out-of-the-way areas in corners, on walls or overhead. Saves valuable floor space.
- MAINTENANCE COSTS ARE LOW. Can be cleaned in a matter of minutes.
- INSTALLATION IS INEXPENSIVE. Only ordinary pipe connections are required.

PICK MANUFACTURING CO.
WEST BEND, WISCONSIN

Bendix Aviation Corporation
HAMILTON DIVISION

Pick Manufacturing Company,
West Bend, Wisconsin

October 27, 1955

Gentlemen:

The Pick Instantaneous Water Heater installed in this plant two years ago has solved most satisfactorily our problem of furnishing both continuous and also large intermittent requirements for hot water.

BENDIX AVIATION CORPORATION
Hamilton Division
D. R. Baird
Plant Engineer

SOLVED SMALL AND LARGE CONTINUOUS HOT WATER REQUIREMENTS FOR BENDIX AVATION CORP.

Other Industrial users are . . .

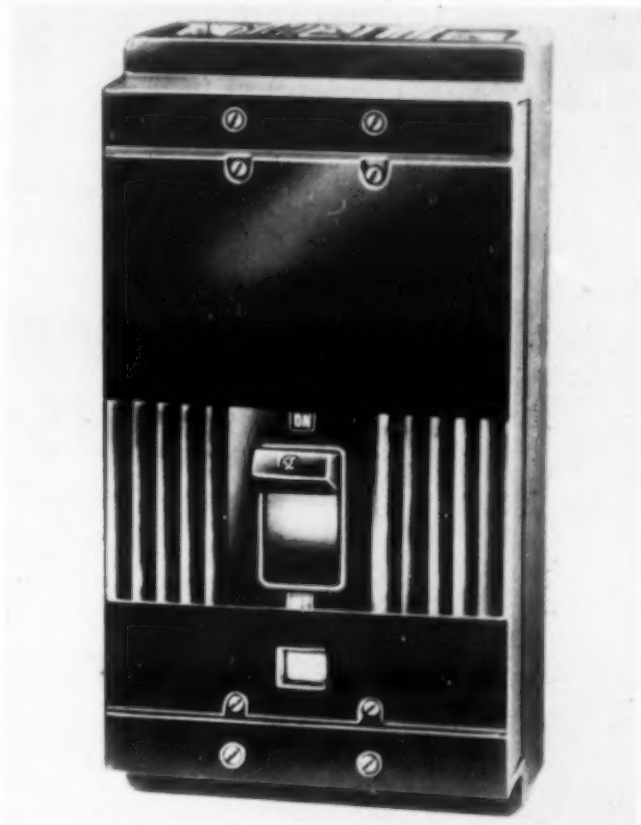
- United States Steel Corp.
- Ford Motor Co.
- H. J. Heinz Co.
- Bethlehem Steel Co.
- Wilson & Co.
- National Gypsum Co.
- National Aniline
- General Aniline

WRITE TO DEPT. IP-257 FOR BOOKLET ON HOW PICK HEATERS CUT COSTS OF HOT WATER.

Circle 132 on READ-N-CIRCLE card for more data

712-Use same frame for big breakers

Compact, molded-case circuit breaker uses the same frame size for all ratings from 125 through 800 amperes. Space savings up to 30% for each breaker can be ob-



tained for ratings above 400 amperes. Circuit breakers are available in 2- and 3-pole designs. Interrupting ratings are 50,000 amperes RMS asymmetrical at 240-volts ac, 35,000 amperes at 480-volts ac, 25,000 amperes at 600-volts ac, and 20,000 amperes at 250-volts dc. New circuit breaker simplifies inventory by incorporating many ratings in a single case. GENERAL ELECTRIC CO.

MORE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 47 or 48.

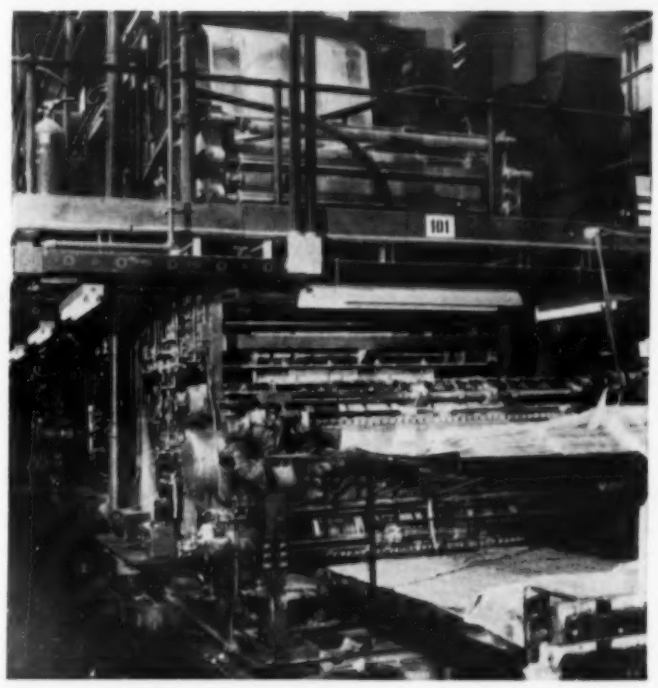
713-Ductile iron fittings don't corrode

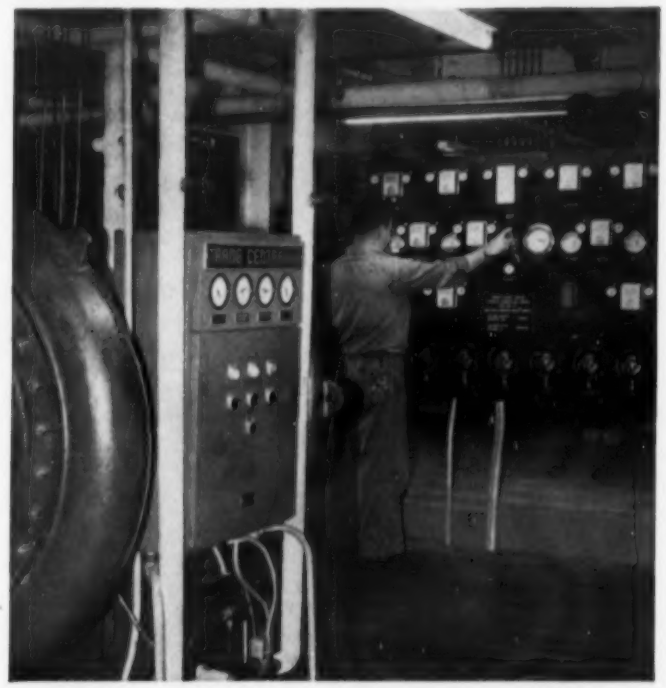
High-strength, ductile cast iron fittings demonstrate superior strength, corrosion resistance, and pressure tightness. Extra strength of ductile cast iron enables de-

signers to use lighter fittings where weight is an important factor. Ductile cast iron betters gray cast iron in corrosion resistance tests. THE KUHNS BROTHERS CO.

(more new products on page 32)

Controlled Water Supply Cuts Downtime... Helps Meet Production Deadlines





PROBLEM: *The Condé Nast Press* formerly used a large volume of city water in the cooling rollers of its giant press batteries. High speed, quality printing of leading magazines such as* House & Garden *and* Glamour *requires a constant source of chilled water to quick-set ink after it is heat-dried. Trouble developed in the summer months—water pressures were too low and the temperatures too high. There was even the threat of a complete water cut-off during shortage periods.*

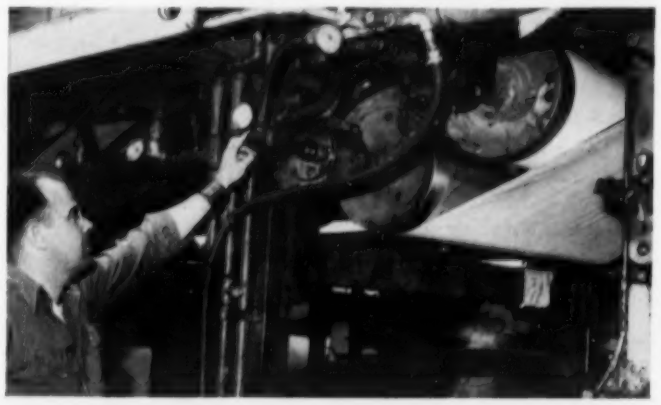
SOLUTION: *The answer proved to be recirculation of the water in a closed system, the use of mechanical cooling equipment and the installation of a flexible, high-efficiency control system to insure uniform water temperature and pressure. The cooling load is handled by two 150 hp compressors and a large heat exchanger. Process water flows through the cooling rollers on the presses and is either returned to the refrigeration units or to the heat exchanger for recooling.*

Precision, waste-free operation of this interesting system is provided by a specially-engineered Johnson Automatic Temperature Control System. The compressors are operated, in sequence as needed, to maintain a constant chilled water temperature. Sensitive, fast response to sudden load changes is a must. As presses start and stop, load shifts often range from zero to 100 per cent and vice versa within minutes.

Whenever the outdoor temperature is sufficiently low, compressors are automatically stopped, and the process water is chilled by passing condenser water from the cooling tower through the heat exchanger. Condenser water temperatures are regulated by a Johnson Thermostat controlling the cooling tower fans. This automatic changeover arrangement minimizes operating costs and helps extend the life of the compressors.

Constant water pressure is maintained by a Johnson Pressure Regulator which modulates a by-pass valve.

If you have a problem of heating, cooling, humidity or process control, Johnson can provide you with an equally successful, economical solution. The recommendations of a nearby Johnson engineer are yours without obligation. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

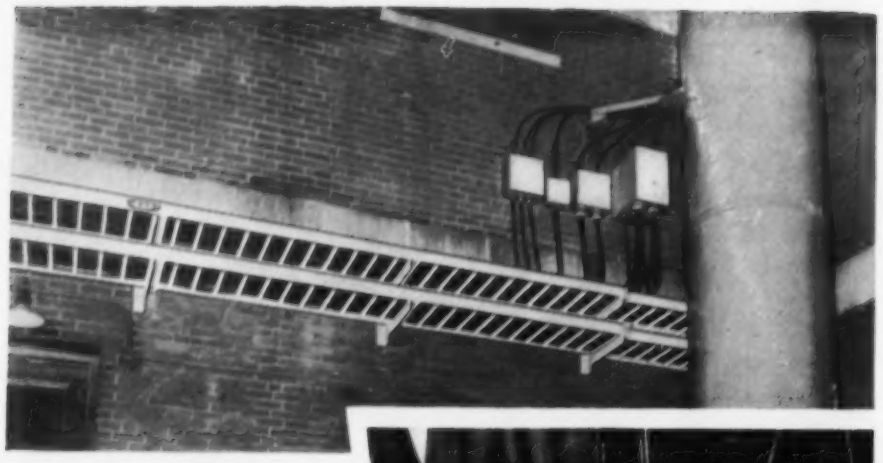


RESULTS: *Variations in the supply, temperature and pressure of water have been eliminated. Downtime is reduced as accurate temperature control prevents excessive ink build-up on the cooling rollers. Application of a heavier ink film can be used to improve magazine quality. Close production schedules are met consistently—without regard to outside water sources.*

*The Condé Nast Press, Greenwich, Conn. J. Gerald Phelan, architect, Bridgeport; Fletcher-Thompson, mechanical engineers, Bridgeport; John Winkel Co., Inc., mechanical contractor, Larchmont, N. Y.

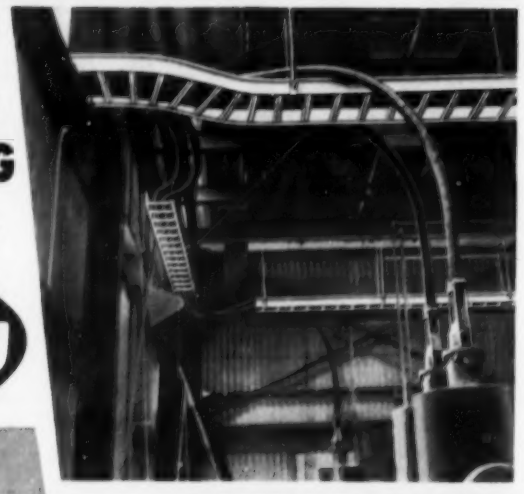
JOHNSON CONTROL
SINCE 1885
PLANNING • MANUFACTURING • INSTALLING

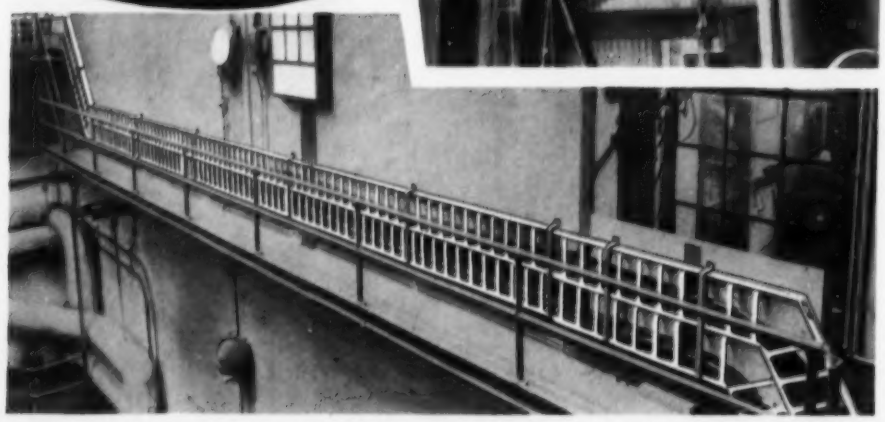
Circle 130 on READ-N-CIRCLE card for more data



a new, superior system of
CABLE and TUBING RACE WAYS...

Globetray
PAT. PENDING





A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

Globetray
THE GLOBE COMPANY

EASY TO INSTALL • SAVES TIME • SAVES ON MATERIAL
GALVANIZED • NO MAINTENANCE PROBLEM

Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.

PRODUCTS DIVISION *The* **GLOBE** *Company*
4036 S. PRINCETON AVE. • CHICAGO 9, ILL.
Circle 113 on READ-N-CIRCLE card for more data

new products

. . . starts on page 28

714-Automatic start-stop for diesels

Heavy-duty Electrostart diesel engine control provides automatic start and stop with protective shutdown features. Control operates on 12, 24, and 32 volts. Can be used with any diesel engine equipped for storage battery starting. Versatile control operates from any remote

pilot switch, including temperature, pressure, float, or load-demand type. Control is available for 5-shot (interrupted-cycle) or 1-shot (single-cycle) cranking. Crank period can be adjusted from 5 to 60 seconds. Automatically resets when engine starts or stops. Protective features include overcranking, overspeed, high water temperature, and low oil pressure. LAKE SHORE ELECTRIC CORP.

715-Condensate trap uses magnetism

Condensate trap for compressed air and gas service discharges through combination magnetic and pneumatic action. Snap-action dumping is accomplished through magnetic attraction. As condensate in trap rises, float buoyancy is restrained by magnet mounted on pivot arm. When float buoyancy overcomes magnetic attraction, float snaps open for discharge. When sufficient condensate has been discharged, magnetic attraction causes valve to snap closed. Trap operates through a pressure range from 10 to 200 psig without clogging. HANKISON CORP.

NATIONAL AIROIL

Oil Burners
OF THE STEAM AND MECHANICAL TYPES NOW COMBINED INTO
Dual Stage BURNERS

Now, at last, the inherent advantages of *both* systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

45 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H.R.T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed description, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
AIR INTAKE DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

Established 1912 — *Incorporated 1917*

NATIONAL AIROIL BURNER COMPANY, INC.
1350 E. Sedgley Ave., Philadelphia 34, Pa.
S. W. Division: 2512 So. Blvd., Houston 6, Texas
Circle 106 on READ-N-CIRCLE card

716-Draft control is automatic

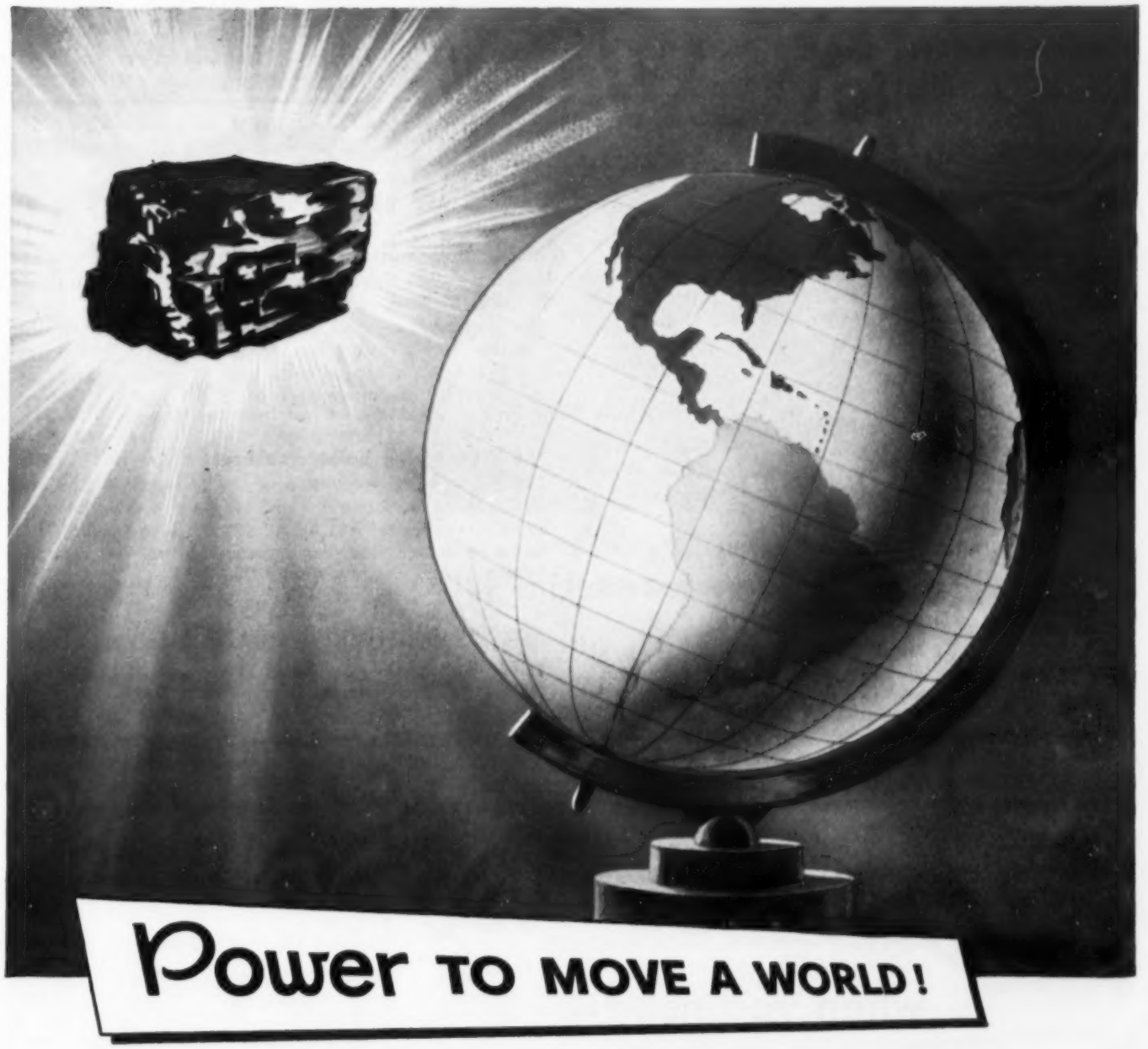
Automatic draft control provides maximum combustion efficiency for gas-, oil-, or stoker-fired equipment. Control combines manual switches, convenient terminal

facilities, and relays within a single compact unit. Control actuates damper to maintain correct draft for all firing conditions and to assure safe starting by opening uptake prior to burner ignition. GENERAL CONTROLS CO.

717-Cuts tubing without distortion

Cutter for copper, aluminum, brass, and plastic tubing handles tube diameter from ⅛ to 3⅛ inches. Each tube is always backed by two cutter rollers when placed

in cutter. This permits straight cuts without tubing distortion. Full-range capacity eliminates need for two separate cutters or hacksaw. ERIE TOOL WORKS. ♦ ♦



➔ America stands on the threshold of a golden age. The sinews of her dynamic economy are flexed as never before. Increased power for untold requirements will be needed . . . and *met* by the most dependable supply of low-cost energy—*Bituminous coal!*

Proven usable reserves in B&O territory contain billions of tons—*available for centuries to come.*

CONTACT OUR COAL TRAFFIC REPRESENTATIVES!
You'll receive details on the most efficient, low-cost Bituminous coal for your particular requirements—
COAL TRAFFIC DEPARTMENT
B&O RAILROAD, BALTIMORE 1, MD. LExington 9-0400

Baltimore & Ohio Railroad

Circle 143 on READ-N-CIRCLE card for more data

basic bulletins

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

AIR CLEANING EQUIPMENT

500-Basics for precipitators

Five basic engineering requirements for a successful precipitator installation are discussed in Bulletin 104. Discusses positive control of gas flow, high, uniform electrode emission, continuous cycle rapping, simple construction, and trouble-free, high-voltage equipment. Twenty-four pages. BUELL ENGINEERING CO.

501-Series on dust and fume collectors

Exhaust fans for dust collecting and air handling are described in Catalog 1002-6. Includes complete performance tables, test curves. THE NORTHERN BLOWER CO.

AIR CONDITIONING, HEATING, VENTILATING

502-Propeller fan data

Revised specifications, performance data, and dimension drawings on entire line of propeller fans are contained in Bulletin A-109B. Includes latest data on reversible, low-noise, and utility fans, with description of heating and cooling units. Includes charts listing performance of each unit with installation diagrams. Forty pages. HARTZELL PROPELLER FAN CO.

BOILERS AND BOILER ACCESSORIES

505-Boiler maintenance tool manual

Boiler tubes need cleaning, replacement? Bulletin 59 describes the entire line of precision-made boiler tube maintenance tools. Includes complete data on tube cleaners, cutters, and expanders. Lists sizes, weights, and operating speed of each unit. Includes description of complete line of accessories. Eight pages. AIRETOOL MANUFACTURING CO.

506-Water-tube boiler features

Water-tube package boilers are described in Booklet 5000. Design and construction features are shown in cutaway drawings with a list of standard equipment, optional equipment, and performance curves. Seven pages. INTERNATIONAL BOILER WORKS CO.

BUILDING CONSTRUCTION, MATERIALS

507-Complete data on nonshrink grout

Bulletin includes complete specifications and data on nonshrink grouting for heavy equipment, anchor bolts, building columns, and bridge seats. Specifications give recommendations on storage, mixing, forming, placing, and finishing. Contains data on strengths, cold- and hot-weather precautions, finishing edges, and removal of leveling devices. THE MASTER BUILDERS CO.

COMPRESSED AIR SUPPLY

508-Get cooler, drier air

How aftercoolers remove moisture from compressed air and gas is explained in Bulletin 130. Schematic flow diagrams show how aftercoolers can cool and dry compressed air systems in any plant. Eight pages. NIAGARA BLOWER CO.

ELECTRIC DISTRIBUTION

511-Protect low-voltage circuits

Bulletin 5042-A describes Cordon current limiting circuit breakers for 100,000 rms amperes protection of low voltage distribution circuits. Includes diagram showing typical uses, ratings, operational characteristic curve. Eight pages. I-T-E CIRCUIT BREAKER CO.

512-Cable troughs are flexible

Cable troughs engineered for easy installation are described in this bulletin. Contains installation instructions, load charts, accessory items, typical installations, and list of distributors. Discusses how simple solutions to problems of change of direction or elevation can be solved with a compelte set of standard fittings, horizontal elbows, inside and outside vertical elbows, ties, and crosses. Twelve pages. THE GLOBE CO.

For Fast Service

when you need

BOILER TUBES *(bent or straight)*

call on these representatives

CLEVELAND	Boiler Tube Co. of America	*Yellowstone 2-6105*
CHICAGO	Boiler Tube Co. of America	*State 2-7955*
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LOS ANGELES	Fred S. Renauld & Co.	*Pleasant 2-6181*
TAMPA	John D. Homan	*Tampa 65-7211*
ATLANTA	E. W. Harbour (College Park)	*Fairfax 1374*
ROANOKE	J. J. Bower	*Roanoke 6-3474*
HAVANA, CUBA	Wm. P. Bryant	*M-9284*
SAN JUAN, P.R.	F. A. Ortez & Co.	*2-4934*

BOILER TUBE CO. OF AMERICA

BOILER TUBE Bldg., McKEES ROCKS, PA. (Pittsburgh District)

3

Circle 100 on READ-N-CIRCLE card for more data

BASIC BULLETINS SUBJECT INDEX

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Boilers and boiler accessories ..34

Compressed Air Supply 34

Electric distribution 34

Electric utilization 35

Fuels and firing equipment 35

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Materials handling (bulk) 36

Mechanical power transmission 36

Pumping equipment 37

Traps, strainers, and separators 37

Water supply and treatment ...37

Single-Point pH Recorder (Strip Chart Assemblies also available)

CAMBRIDGE pH INDICATORS and RECORDERS

Labor saving — profit producing!

In addition to portable pH meters, Cambridge makes line-operated Direct Reading pH Indicators and Recorders for permanent installation. They are accurate, stable and assure continuous and trouble-free performance. Either the Recorder, Indicator or both, may be located at any reasonable distance from one or several sampling points. The Glass Electrodes are placed in vapor-tight housings of clog-free sampling chambers.

Send for Bulletin No. 910 T

CAMBRIDGE pH EQUIPMENT

CAMBRIDGE INSTRUMENT CO., INC.

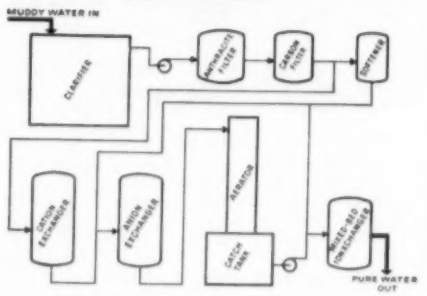
3524 Grand Central Terminal, New York 17

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS

Circle 133 on READ-N-CIRCLE card for more data

ILLCO-WAY
ionXchange

HIGH-PRESSURE BOILERS NEED PUREST WATER



An ILLCO-WAY System, incorporating up-to-date ionXchange equipment, offers the best opportunity available today for obtaining the high-purity water that modern high-pressure boilers *must* have to avoid serious loss of operating efficiency. Such a System will take the muddiest kind of hard river water and clean it up so that suspended impurities, mineral content, and dissolved solids are reduced to almost unmeasurable quantities. The result — top boiler performance, always, and top *turbine* performance.

ONE SOURCE FOR THE WHOLE SYSTEM

Today, such a System can be obtained, *complete,* from a single source — Illinois Water Treatment Company. We design and manufacture every element to solve successfully the particular application. You do not need to combine a part from here and a portion from there — you get it *all* from us, all tanks, all piping, all valves and controls, all resins and other materials, all carefully selected to suit *your* needs. *Consult our experienced engineers at the next opportunity . . .*

ionXchange
ILLINOIS WATER TREATMENT CO.
ILLCO-WAY
840 CEDAR ST.
ROCKFORD,
ILLINOIS
NEW YORK OFFICE: 141 E. 44TH ST., NEW YORK 17, N. Y.
CANADIAN DIST. PUMPS & SOFTENERS, LTD. LONDON, ONT.

Circle 104 on READ-N-CIRCLE card

513-New variable transformer ratings

Types 136 and 236 Powerstat variable transformers — design, new ratings, and performance — are shown in eight-page Bulletin P354. THE SUPERIOR ELECTRIC CO.

ELECTRIC UTILIZATION

515-Synchronous speed from induction motor

Synduction motors offer synchronous speed with induction-motor simplicity, in sizes to 40 hp. Available in drip-proof, splash-proof, totally enclosed, and explosion-proof designs. Bulletin 51B8440A lists many uses of this custom-built motor. Four pages. ALLIS-CHALMERS MANUFACTURING CO.

516-Heat with electricity 101 ways

Industrial electric heating applications and methods are described in 32-page Booklet, "101 Ways to Apply Electric Heat." Illustrated case histories show experience-tested ways to apply metal-sheathed Chromalox electric heating units in industrial jobs. EDWIN L. WIEGAND CO.

FUELS AND FIRING EQUIPMENT

518-Industrial process heating handbook

New handbook provides plant engineers with basic concepts of industrial heat processing and heat control. Pruned of technical language, the handbook goes from a discussion of heat-to-fuel cost comparisons to design elements. Common formulas used in calculating heat and oven requirements are included. Bulletin 555 — a refresher course in process heating — is a must for all plant engineers. Twenty pages. MICHIGAN OVEN CO.

INSTRUMENTS AND CONTROLS

520-Switches insure safe operation

Bulletin 856 contains information on full line of mercury switches and controls. Lists mercury switch controls for temperature, pressure, oil burner controls, stoker, liquid-level, and boiler feedwater pumps. Gives advantages of mercury switches, such as visible contact, elimination of contact wear, and seal from hazardous atmospheres, dirt, and corrosion. Fifty-two pages. THE MERCOID CORP.

523-How to select liquid-level control

Bulletin 1 discusses the factors to be considered in selecting a liquid-level control. Includes controls in types and sizes for handling practically any liquid, at any pressure and any temperature. Eight pages. MAGNETROL, INC.

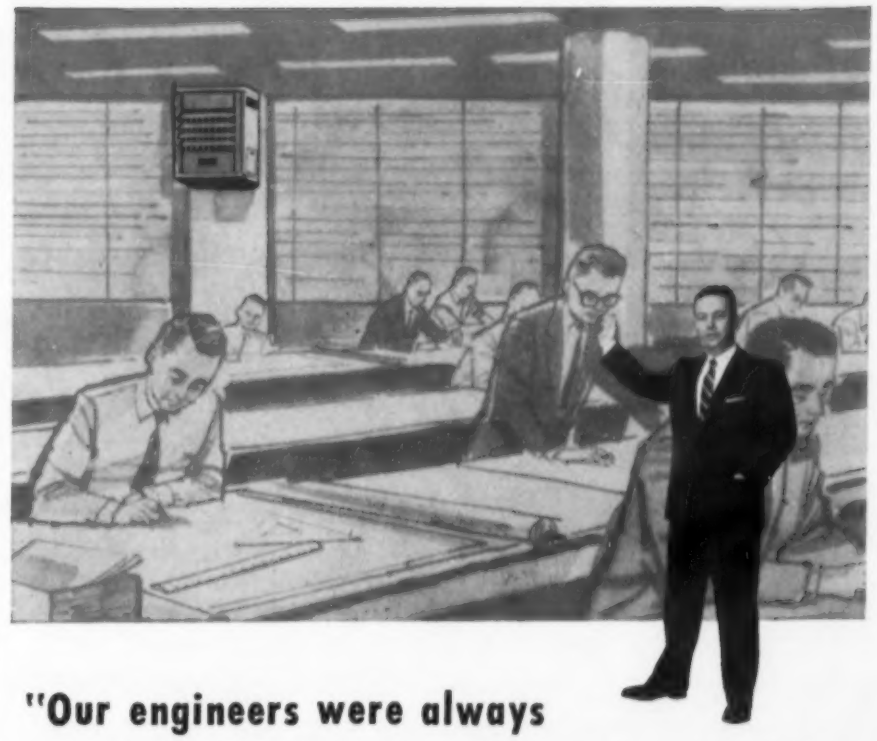
524-High-pressure rotameter kit

High-pressure rotameter kit for safe use at pressures up to 3000 psi at 200 F is described in Bulletin 140. Includes tables giving range, float material, and flow rates for the complete line of kits. Contains information on how to solve rotameter problems quickly and easily. Eight pages. BROOKS ROTAMETER CO.

525-How to bring gage face to eye level

Installation sketches in Bulletin WG-1814 show mirror arrangements that bring Color-Port gage face to easy-

(more basic bulletins on page 36)



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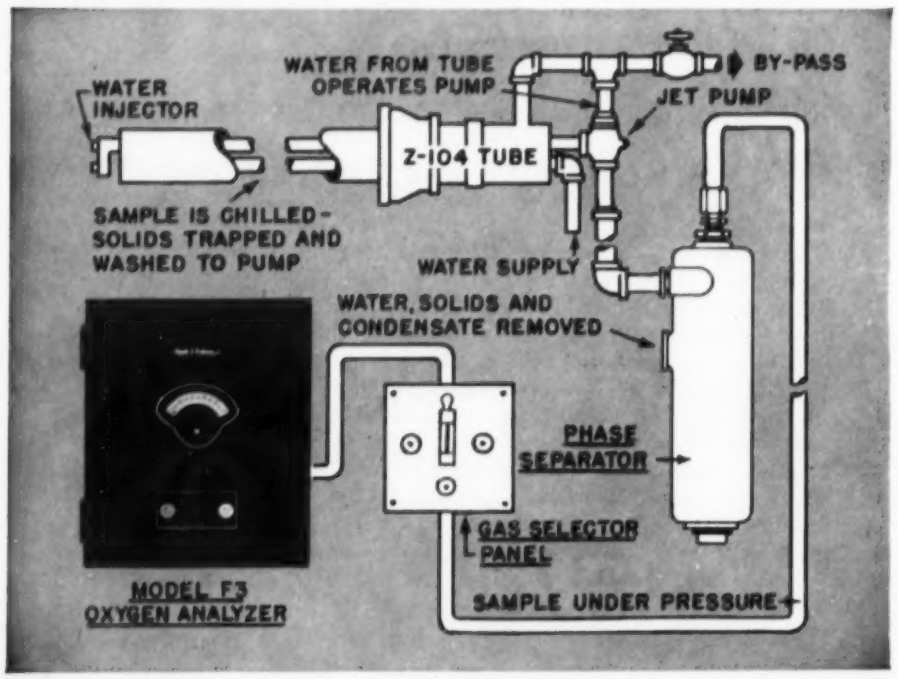

The diagram (above) shows a typical analysis system for boilers. The incoming sample gas is first chilled and washed . . . then passes through a Separator where the condensables and solids are removed. The resulting clean, dry sample gas flows under pressure to the Gas Selector Panel (for selecting "Zero," "Span" and "Sample" gases) . . . then into the Analyzer where the oxygen content is quickly measured. The Analyzer may be used with any standard recorder or controller.

Result – new speed, simplicity and accuracy in controlling air-fuel ratios, with important savings in fuel and operating costs!

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basic bulletins

. . . starts on page 34

to-read eye level. Port-type arrangement and two-color readings aid visibility, reduce maintenance. Six pages. YARNALL-WARING CO.

527-Gas analysis instrument guide

Use and operation of thermal conductivity analyzers for continuous gas analysis is described in Bulletin TD-507. Sixteen pages. ARNOLD O. BECKMAN, INC.

LIGHTING

529-How to calculate illumination level

Bulletin L-110-E includes data on brightness, light distribution, and illumination-level calculations. Describes Twinlite lens panel for use in high ceiling troffers. Four pages. CORNING GLASS WORKS.

LUBRICATION

530-Do's and don'ts for bearings

A helpful list of "do's" and "don'ts" to prolong bearing life appears in Bulletin 506. Also included is information on the storage and handling of industrial lubricants. Four pages. NEW YORK AND NEW JERSEY LUBRICANT CO.

MAINTENANCE ITEMS

533-Preload washers control setting stress

Preload indicating washers that control setting stress to within ±10 percent are described in Bulletin 2165. Washers consist of two concentric steel rings sandwiched between two close-tolerance washers. Inner concentric ring is compressed as bolt is tightened. When inner ring is compressed to point where outer ring binds against adjacent washers, desired preload is induced. Twelve pages. STANDARD PRESSED STEEL CO.

534-How are pressure vessels made?

Specialized manufacturing facilities for fabrication of pressure vessels, high-pressure piping, and unusual weldments are described in Bulletin GS-56-4. Describes equipment such as: an 8000-ton hydraulic beam press, a 50-ton crimping press, submerged arc automatic welding machines. Eighteen pages. FOSTER WHEELER CORP.

MATERIALS HANDLING (BULK)

539-How to store bulk materials

Storage bins for bulk materials such as ashes, coal, coke, sand or lime are discussed in this bulletin. Contains tables of densities of flowable materials, capacities, description of wall construction, and test data. Twenty-nine pages. THE NEFF & FRY CO.

PIPING, TUBING, AND HOSE

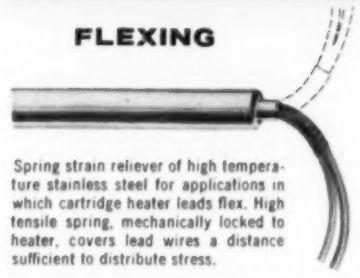
544-How to install pressure pipe

Manufacturer's recommendations for installing "Transite" pressure pipe to meet all conditions are contained

TAKE YOUR PICK!

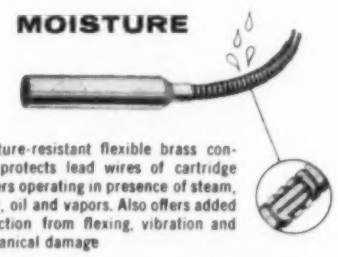
Special Chromalox features solve 3 spot heating problems

FLEXING



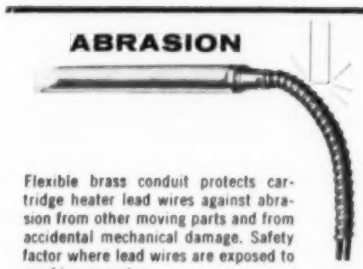
Spring strain reliever of high temperature stainless steel for applications in which cartridge heater leads flex. High tensile spring, mechanically locked to heater, covers lead wires a distance sufficient to distribute stress.

MOISTURE



Moisture-resistant flexible brass conduit protects lead wires of cartridge heaters operating in presence of steam, water, oil and vapors. Also offers added protection from flexing, vibration and mechanical damage

ABRASION



Flexible brass conduit protects cartridge heater lead wires against abrasion from other moving parts and from accidental mechanical damage. Safety factor where lead wires are exposed to machine operator.

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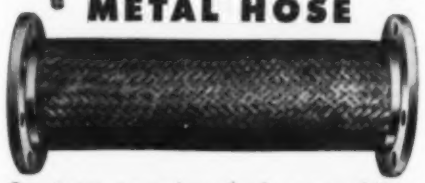

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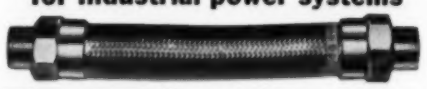

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in Bulletin TR-180A. Describes and illustrates details including loading and unloading, machining and cutting, flange installation, and supporting. Includes dimensional data and pipe weights in sizes from 4 through 16 inches. Also includes complete list of fittings and connections. Forty-eight pages. JOHNS-MANVILLE.

PUMPING EQUIPMENT

547-Automatic sump pump data

Complete engineering data on a line of sump pumps that covers every application are presented in Bulletin 5530. Submersible sump pumps, vertical pumps, and hydraulic operated drainers are discussed. Four pages. PENBERTHY INJECTOR CO.

548-Pumps for every purpose

Positive displacement rotary pumps for every industrial use are described in detail in Bulletins 100 to 105. Includes a wealth of information on operating capacity, performance curves, installation dimensions, and operating details for both direct and V-belt drives. TUTHILL PUMP CO.

TRAPS, STRAINERS, AND SEPARATORS

550-Quick-coupling fluid filters

Construction and operation information on non-short-circuiting fluid filters and strainers is presented in Bulletin 45570. Mesh sizes are tabulated with sizes and ratings of multiplex units. Four pages. RONNINGEN MANUFACTURING CO.

551-Steam trap manual

Real low-down on steam trap operation is contained in "Armstrong Steam Trap Book." Includes many illustrations of correct steam trap installations. Cutaway sections show steam trap operating principles. Lists steam traps for all sizes from ½ to 2 inch. Includes data on how to trap unit heaters, submerged steam coils and tubes, siphon drains, and low pressure heating systems. Includes illustrations of typical piping layouts incorporating steam traps. Forty-six pages. ARMSTRONG MACHINE WORKS.

WATER SUPPLY AND TREATMENT

555-Simplify water treatment

Information to accurately select water treating equipment for any plant, industry, or other institution is contained in this bulletin. Three basic exchange materials are described. Includes water and brine distribution mechanism and exchange material depth. Sketches show direction of water and brine flow during service, brine-rise, and regeneration cycle. Contains specifications including flow rates, exchange capacities, amount of salt, and shipping weight. Eight pages. ILLINOIS WATER TREATMENT CO.

556-Solids-contact reactor handbook

Bulletin 5001 discusses theory and problems of cold water clarification. Includes photographs and drawings of solids-contact reactors. Includes section on auxiliary and supplemental apparatus. Twenty-four pages. COCHRANE CORP. ♦♦

. . . and the P-D Tubular is even more radical. Unique internal ducting, called *PLENAFLO, actually provides a plenum *within* the collector casing which permits direct gas flow to the inlet of the tubes *unhampered by a maze of outlet tubes.* It also permits the use of tube bundles so designed that the gas *never has to pass more than two tubes* to reach the most isolated central tube. This patented feature reduces resistance and eliminates gas recirculation that can occur with outlet tubes of varying length.

Further improvement of gas flow was accomplished by designing the tube inlet slots to permit the gas to enter the tube at a natural angle and around the complete periphery of the tube. This reduces sudden changes in direction of gas flow and attendant wear.

Ask our project engineers for information on this unique PLENAFLO collector. Its efficiency and limited space requirements will be of particular interest. Available in either vertical or horizontal tube design sheets, it assures installation flexibility.

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Ever looked in your reference file for specific information when you needed it—and found a void. Or perhaps you found *some* material, but not the right kind. We *all* have. Well, here's a chance to be sure you have a *lot* of information on one subject, at least—heat processing.
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Better water treating

. . . starts on page 12

uses soft water that has been chilled to 35 F in a flooded-type Freon cooler. This cooler is served by two centrifugal compressors with 1500 tons total refrigerating capacity. Third stage uses 20 F soft water (with glycol added as an antifreeze). Air leaves third stage at 33 F and 45 psig. It then contains only 7 grains of water per pound of dry air. Further drying, when required, is accomplished with an activated alumina adsorbent. This results in a final water content of less than 1 gr/lb. Lower air temperatures are provided, when required, by passing air at 122 lb/sec through an expansion turbine to produce temperatures as low as —100F.

Other soft water uses in the equipment building are: cooling air for air-cooled compressor motors; cooling central lubrication system heat exchangers that serve all motor and compressor bearings in the building; and cooling hydraulic fluid in controls.

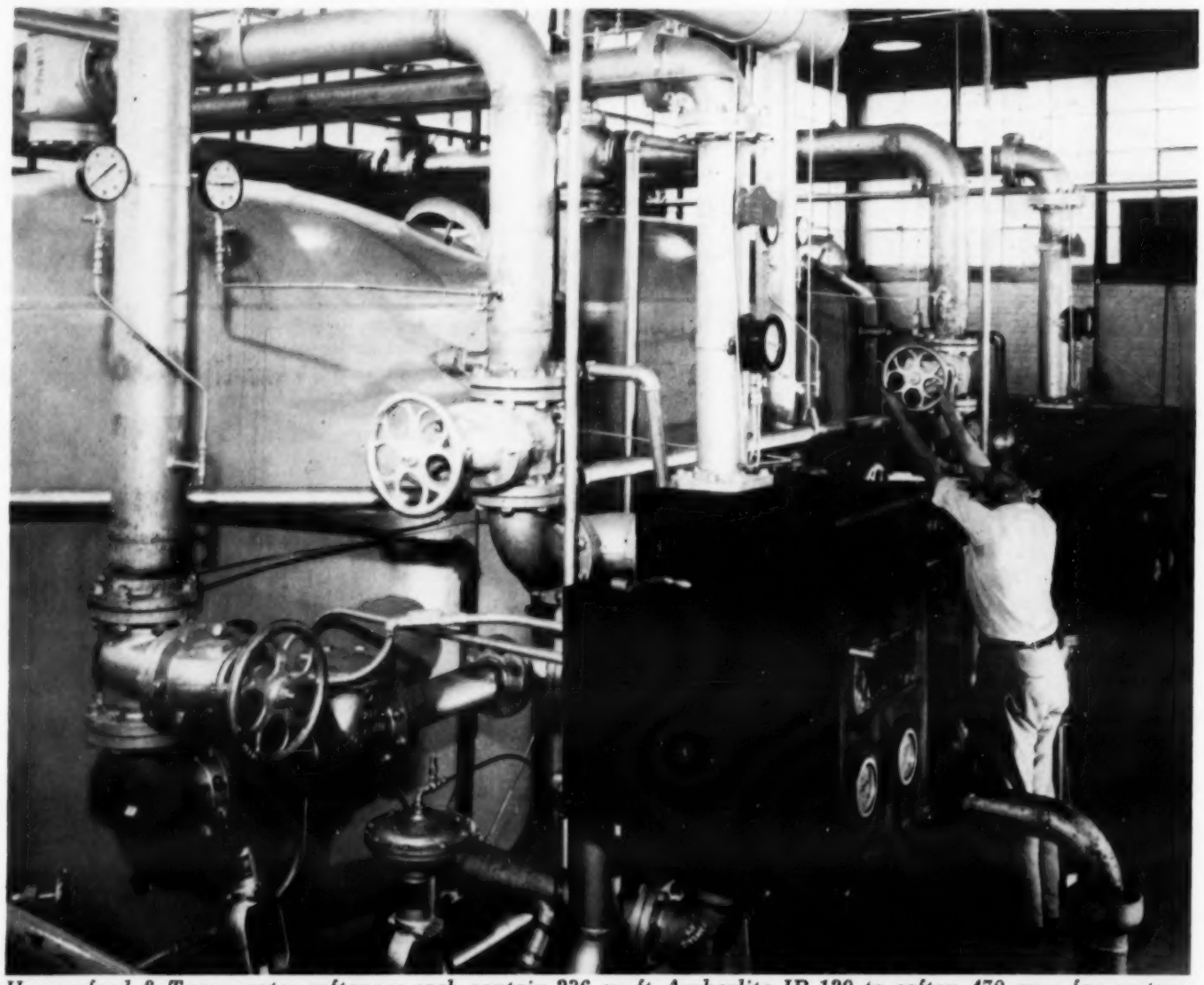
Water must be soft for all these functions. Otherwise, the large water volumes circulated would build up scale quickly in piping and equipment. This would impair flow, reduce heat exchange efficiency, and ultimately cause damage to critical parts.

Huge amount of soft water for these various operations — up to 32,000 gpm — is supplied from a centralized recirculating system. Main system elements are: two Amberlite water softeners, a 500,000-gal reservoir, deaerator towers, and a cooling tower.

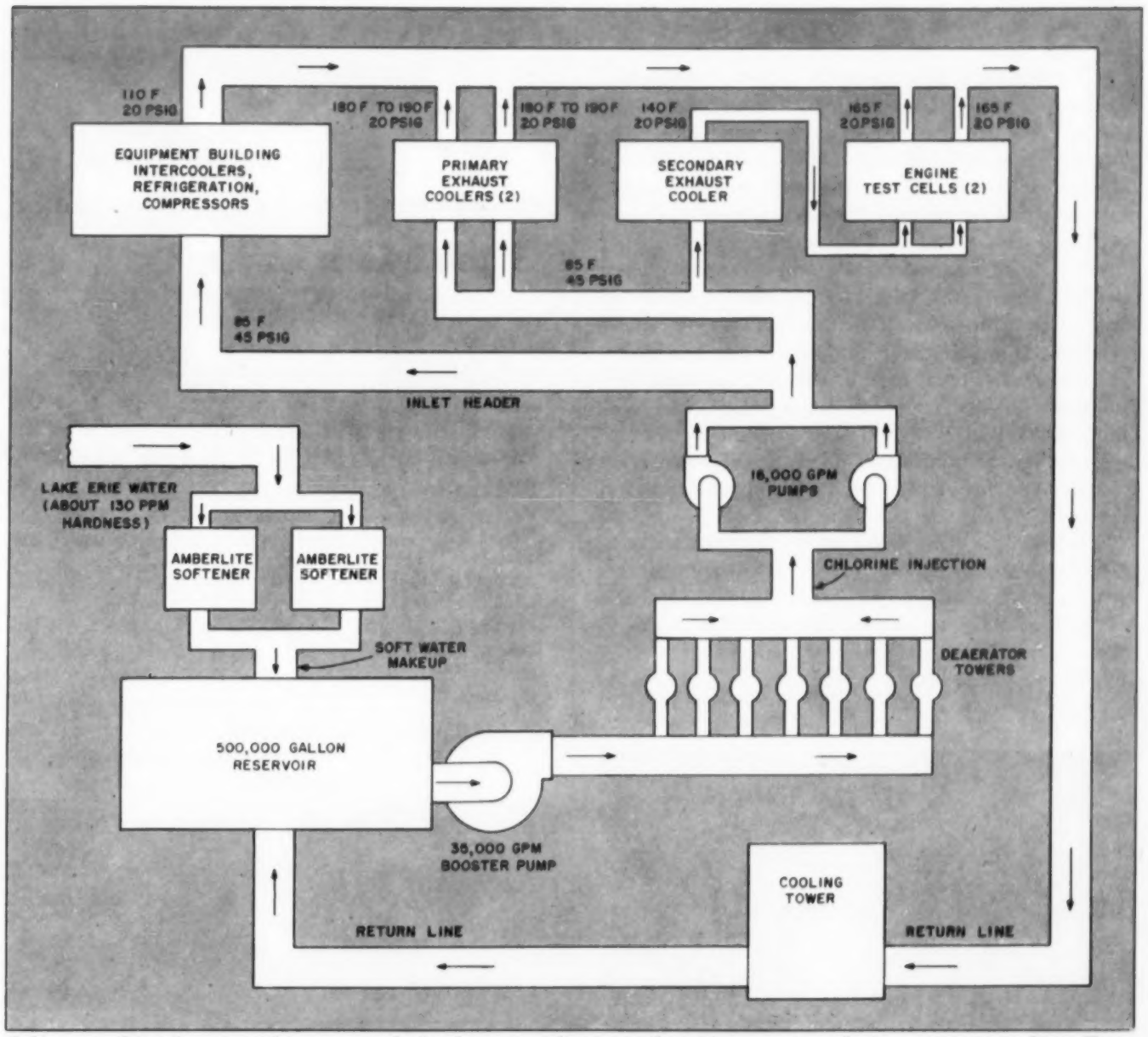
how makeup water is supplied

Although this is a recirculating system, evaporation losses, spillage, and blowdown from the reservoir (to control dissolved solids content) require frequent soft water makeup. Makeup water is introduced from water softening system on demand from reservoir water-level controls.

Makeup water is supplied by two Hungerford & Terry water softeners. Each water softener contains 236 cu ft of Amberlite IR-120 (a high-capacity cation



Hungerford & Terry water softeners each contain 236 cu ft Amberlite IR-120 to soften 470 gpm for system.



Schematic flow diagram of system includes location of principal equipment in relation to system flow. Temperatures and pressures of circulating water indicate heat gain and pressure drop through exhaust coolers.

exchange resin manufactured by Rohm & Haas). Each softener, 10 foot dia by 9 feet high is designed to soften 470 gpm to virtually zero hardness. Incoming water from Lake Erie has an as-received hardness of 6 to 8 gr/gal (100-135 ppm).

When water is needed in the equipment or testing building, it is drawn from the soft water reservoir by a 35,000-gpm booster pump. Pump delivers water to a line of seven deaerators which can process a total of 32,000 gpm. These deaerators are maintained at a high vacuum by steam ejectors. They extract dissolved oxygen picked up by water in the cooling tower or during storage. Removing this gas helps prevent corrosion in piping, heat exchangers, refrigeration units, and other equipment — particularly in high-temperature water jackets.

Water is delivered from the deaerators into a 48-inch dia main header by either one or two 16,000-gpm pumps, each driven by a 700-hp motor. Pump operation and pumping rate are governed automatically by system demand. One pump is equipped, also, with an auxiliary 250-hp motor. This pump keeps water circulating in the system to prevent freezing during winter months if equipment is idle.

chlorine protects against algae and slime

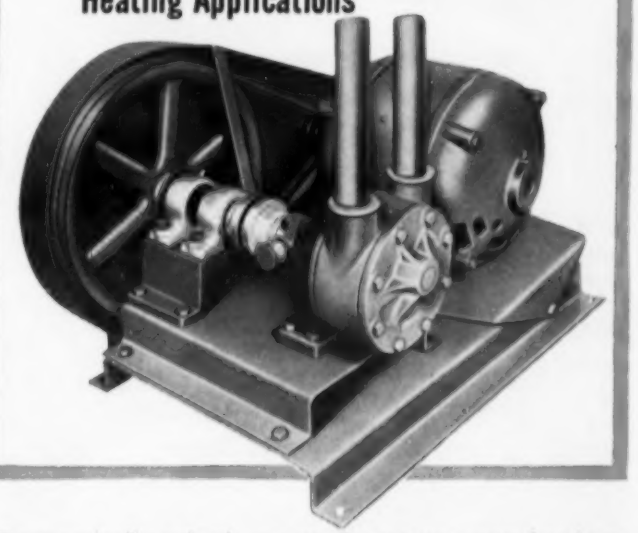
Liquid chlorine is injected into the 48-inch header just ahead of the supply pumps in proportion to the flow rate to prevent formation of organic slimes and algae growths. Water is distributed from the header to successively smaller lines — a 36-inch line to primary coolers, and 18-inch lines to secondary cooler, water jackets on test chambers, and refrigeration and heat exchange equipment building. Water is collected in a 48-inch return line after use, at a maxi-

(continues on page 40)

new

TUTHILL
SU
PUMP UNIT

- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

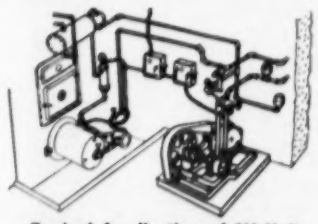


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅝". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

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TITLE _____
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951 East 95th Street, Chicago 19, Ill.
Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada
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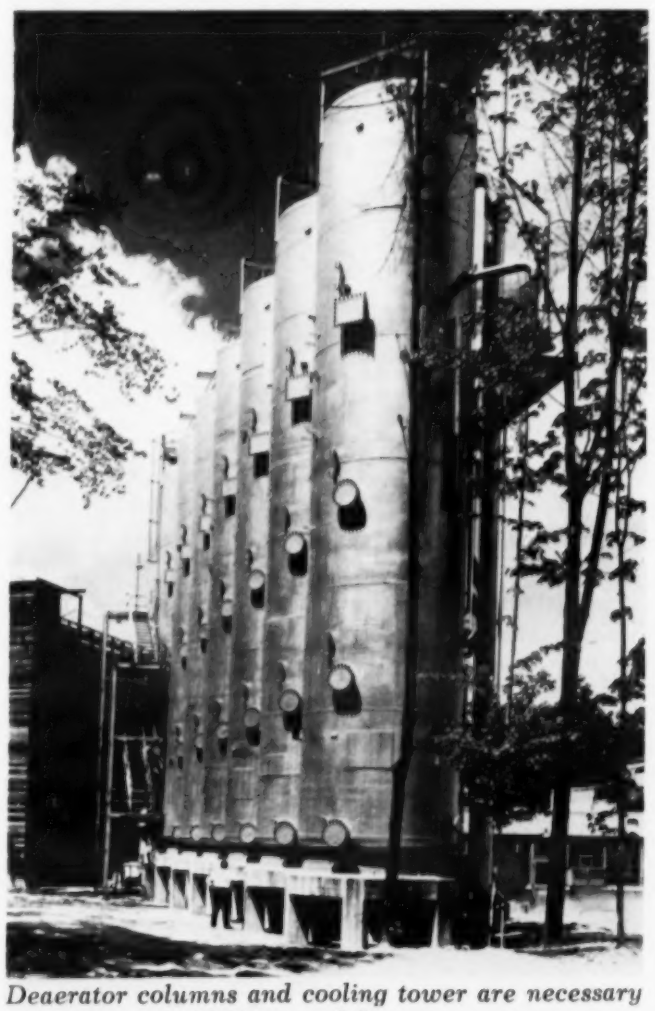
mum temperature of 170 F. This heat is dissipated in a high-capacity redwood cooling tower. Water, now at about 85 F, returns to the reservoir for reuse.

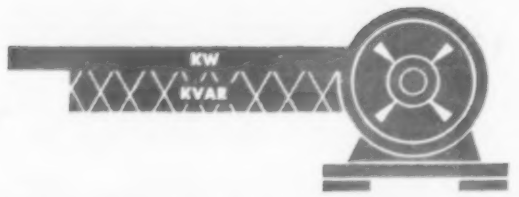
Water softening operation is fully automatic. Each softener feeds the reservoir on demand from level controls until approximately 570,000 gal are softened. As soon as this quantity passes through the water meter, electric contacts in the meter actuate a 6-inch multiport poppet valve. This valve carries out an automatic cycle causing the softener to be backwashed, regenerated with 1100 pounds of salt in solution, rinsed, and finally returned to service. No direct labor is required for any part of the process.

Soft water's importance in this recirculating system at the NACA Lewis Laboratory cannot be overemphasized. Water is used as a coolant for equipment valued at millions of dollars and which is in constant use for urgent flight propulsion research projects.

This same problem arises wherever hard water is used for heating, cooling, or refrigeration. Investment in a water softener is repaid many times when savings such as increased equipment life, reduced maintenance, increased efficiency, and lowered power costs are added up. ♦ ♦



Deaerator columns and cooling tower are necessary components in 32,000 gpm laboratory water system.



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Write for complete information in Bulletin PF-1150, available free on request to the Industrial Capacitor Division, Sprague Electric Co., 351 Marshall St., North Adams, Mass.

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The mark of reliability **SPRAGUE**

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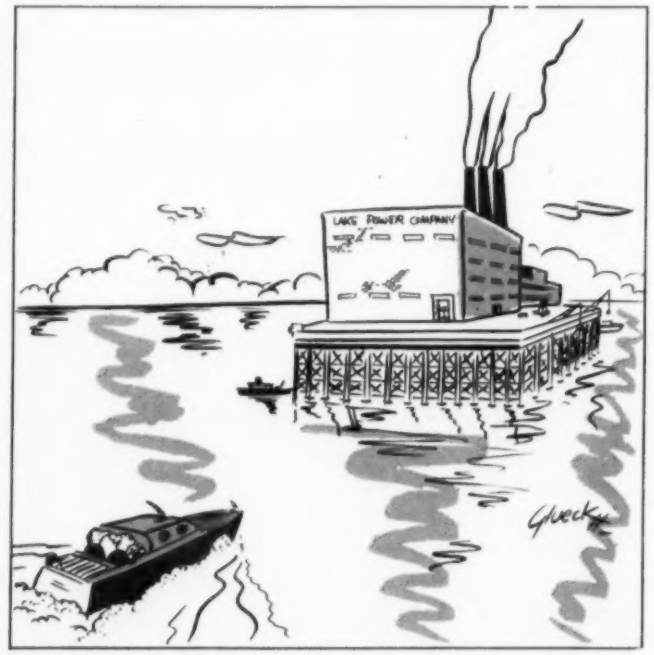


"We were primarily concerned with an abundant supply of feedwater —"

Don't mutilate this copy . . . .
just send for any tear sheets that you might want, and let the next fellow enjoy it, too.

Simplified tube treatment

. . . starts on page 21

the Missouri River, is as follows:

pH	7.8
$CaCO_3$	230 ppm
HCO_3	175 ppm
Sulfate	158 ppm
Manganese	0.11 ppm
Magnesium	20 ppm
Total solids	418 ppm

With existing water treatment, scale deposition and rust were found in boiler tubes and in all condenser piping and tubes. In two years, 26 boiler tubes were replaced because of corrosion failure. Expense records for replacing boiler tubes were not kept. In terms of time, however, each tube replacement involved a minimum of nine man-hours plus intangible loss of boiler downtime.

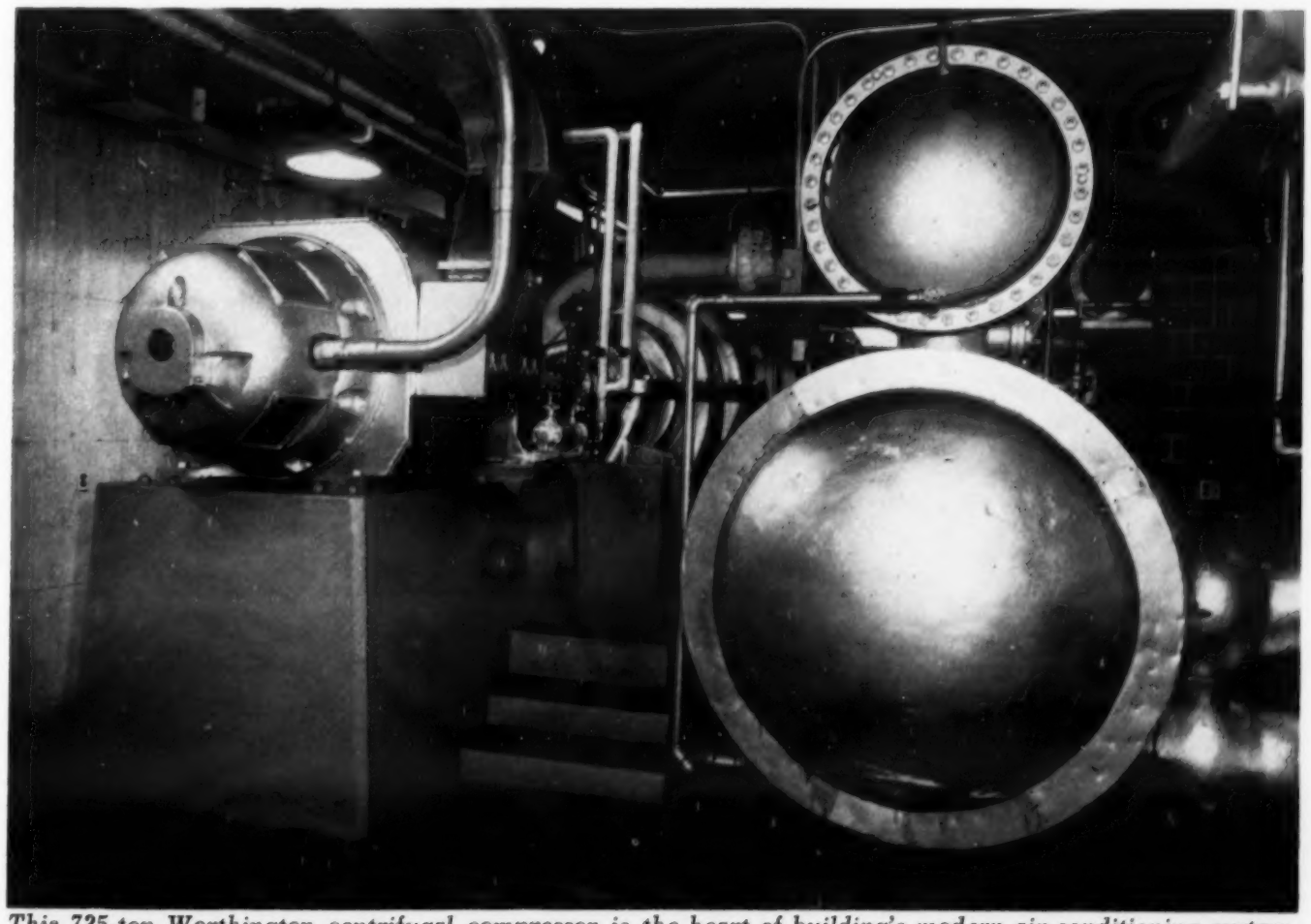
Boiler room contains 3 Kewanee 178-hp type C, oil- and gas-fired boilers. Boilers provide steam, used with heat exchangers, for forced hot-water heating and for steam tables in the cafeteria. Usually, only one boiler is fired to maintain the load. Second boiler is put in operation when outside temperature drops to 26 F. Third boiler is needed only when temperature drops below 10 F.

Air-conditioning system consists of one 725-ton Worthington centrifugal compressor and six 50-ton York reciprocating compressors. To insure close control of inside temperatures, 119 separate temperatures are monitored. Accurate data are necessary to maintain ideal working conditions.

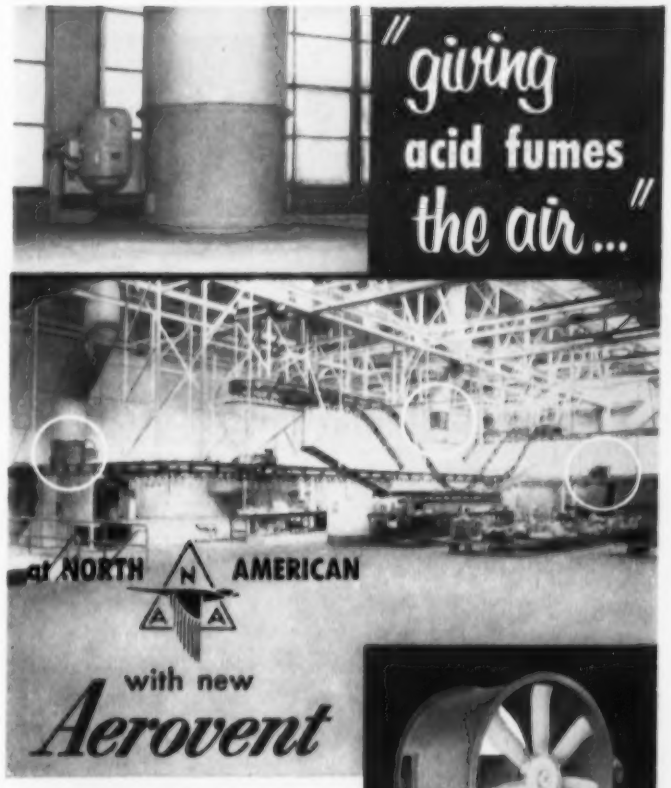
SOLUTION: Raw water is first run through Permutit Q-type zeolite softeners. Additional treatment is simplified to consist of merely adding treating compound when required as determined by water tests. Average daily treatment is ½-gallon of North American Mogul MP-31 compound and ¼ gallon Mogul M-16 compound.

Since using this water treatment, boiler and heat exchanger tubing has been free of rust and scale. No tube replacements have been necessary during the past year. Close cooperation and frequent, dependable inspections by the North American Mogul field representative have relieved plant operators of many water treatment problems. ♦♦

Water treating compounds MP-31 and M-16 are made by The North American Mogul Products Co., Dept. IP, Standard Building, Cleveland 13, Ohio. For more information, circle 520 on READ-N-CIRCLE card, page 47 or 48.



This 725-ton Worthington centrifugal compressor is the heart of building's modern air-conditioning system.



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Rent speed and accuracy

. . . starts on page 14

tions. The circuit component section, for representing loads and feeders, is on the left. In the center, at the plug-and-jack section, circuit interconnections are made.

Q: How many analyzers are available to industry?

A: There are approximately 40 analyzers within the United States today. Fifteen are available on a daily rental basis. They are located in various parts of the country: five in the East, seven in the Midwest, two in the South, and one in the West. Any of these facilities may be scheduled with reasonable advance notice. The network analyzer, which you are inspecting, has just been put into operation in Philadelphia. This particular unit has many features that will use engineers' time more effectively.

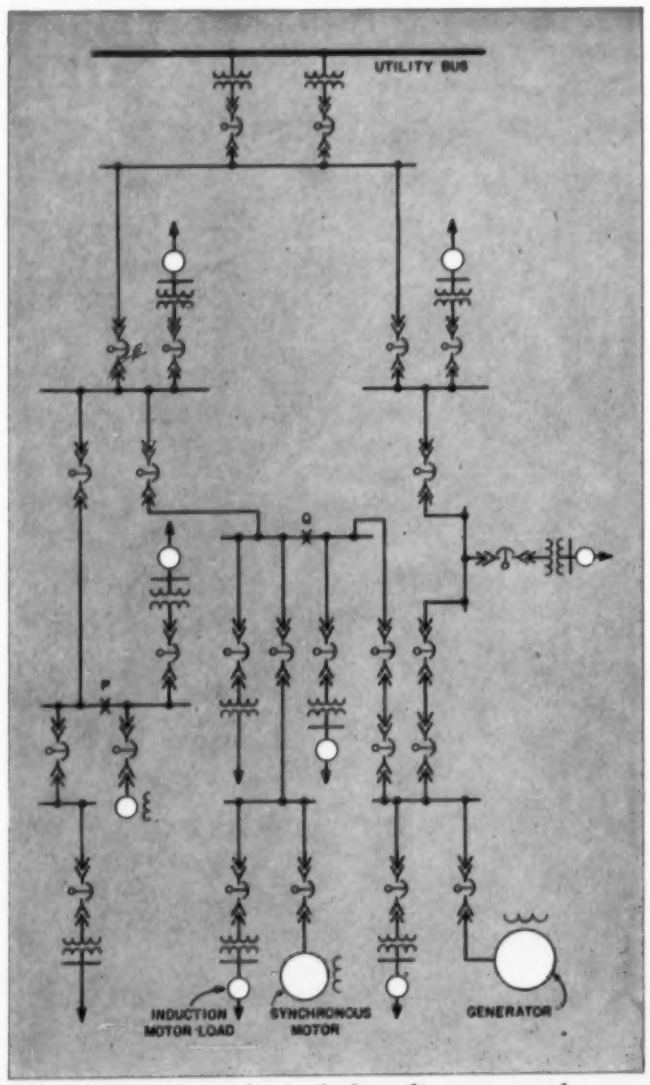


Fig. 1—This system's single-line diagram can be represented on analyzer circuits by two power sources.

Q: Specifically now, what kinds of circuits could we put on an analyzer?

A: Consider a system as shown in Fig. 1 for example. Two power sources on the analyzer would be used, one to represent the utility bus and one to represent the small customer-owned generator. All feeders and transformers would be represented by impedance units. Resistance and reactance would be set as a percentage of the actual impedance in each line. Each actual load would be represented by an equivalent load on the analyzer. If a load consisted of rotating machines, it could be represented as a load or as a voltage source with proper impedance (such as subtransient or transient) as needed in a fault study.

Q: Can different operating conditions be represented?

A: With a complete miniature system setup, any electrical conditions that can be encountered on an actual system can be simulated. A load flow or short circuit problem, whether on the largest or smallest system, can be thoroughly investigated. We need only know the nature of the problem (such as closing a switch, opening a feeder, shutting down one supply, starting a large motor, or applying a fault). Stability problems also may be studied, but they are very rare on industrial systems.

Q: What kinds of data are required to get a given system ready for analyzer study?

A: Since all network analyzer facilities are staffed by qualified engineers to provide consultation and guidance, it is only necessary that plant engineers bring ordinarily available system data . . . . such as impedance values, equipment name plate ratings, and their system single-line diagram.

Q: Can you cite a specific example where time is saved in industrial system calculations?

A: Yes. Consider again our system in Fig. 1. Longhand calculation of a three-phase fault study (by far the easiest to calculate) takes at least two delta-wye conversions plus some parallel impedance reductions to determine the equivalent impedance and thereby determine available short-circuit current. Furthermore, in longhand calculations we assume that internal voltages of all rotating machines and sources are equal and have the same phase angle. Otherwise, calculations would be very complex.

Although this assumption is made on analyzer studies at times, it is very easy to keep each power source separate. We estimate that calculation time would run from 3 to 4 hours by longhand . . . . whereas only about 30 minutes would be needed to find short-circuit current using an analyzer. At the same time, the current in all other circuits could be read. Once the system has been set up, it would take approximately 3 minutes to remove the fault

at P, place it at Q, and take a completely new set of readings.

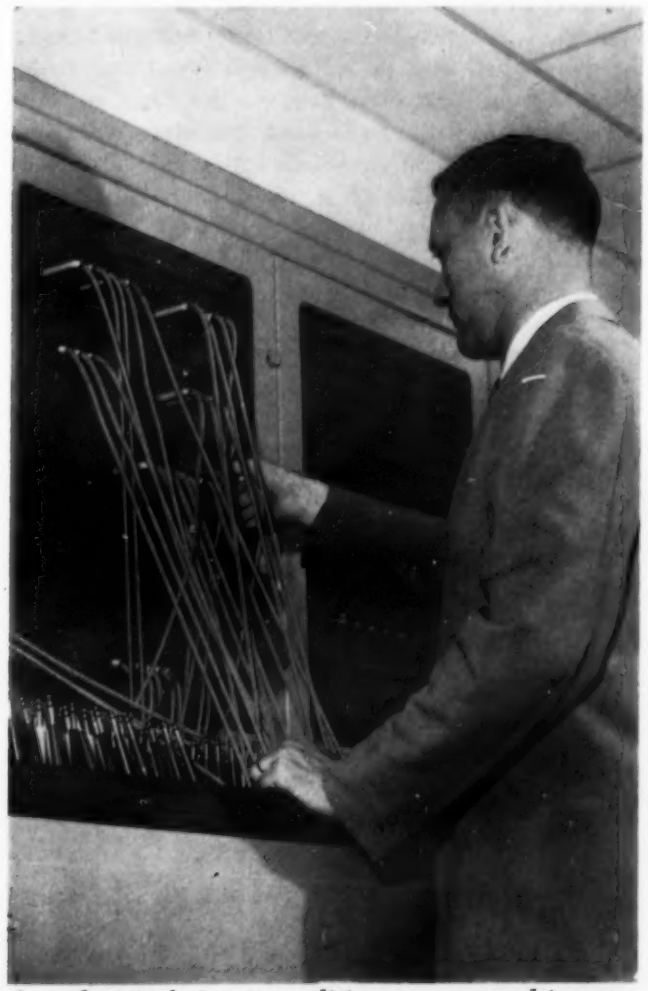
Q: What about a more difficult problem . . . . say a fault on every bus? How much time would that take on an analyzer compared to longhand calculation?

A: For a fault on every bus and current readings being taken in all associated circuits for each fault, the study time required on an analyzer would be within one hour. Longhand calculations require a minimum of two days. Remember, too, that all such short-circuit currents are calculated under one particular operating condition. Longhand calculations require considerably more time, perhaps a day, to perform additional calculations for other operating conditions. On an analyzer, *all* this extra data would take only another 30 minutes or even less. For a single line-to-ground fault or a load-flow analysis (generally more complicated), a greater percentage of time would be saved by using an analyzer.

Q: What is behind today's increasing use of analyzers for studying industrial systems?

A: Well, the trend in modern analyzers has been toward increasing setup speed and obtaining greater accuracy. Increased speed and cutting out many prestudy calculations more readily lend these new analyzers to use for one- or two-day studies, such as those involving smaller electrical systems typical of industrial plants.

To use the analyzer, engineers need supply only the available data plus a single-line system diagram.



Any electrical circuit condition encountered in actual systems can be directly simulated on the analyzer.

Q: Well, let's get down to cases. Take an engineer who has used an analyzer once. How does he usually feel about these analyzers after having used one?

A: That question brings me to the last reason for using network analyzers . . . . and it's a good one. Engineers *have fun* feeding their problems in and watching the answers come out right away and on the button. ♦ ♦

Network analyzer facilities are available on a rental basis. For more information, circle 580 on READ-N-CIRCLE card, pages 47, 48.

What are you doing . . . .
about improving your status as an engineer? Kenneth A. Roe, executive vice president, Burns and Roe, Inc. suggests that many engineers expect more than they are prepared to give. Read Forum this month.
see page 3.

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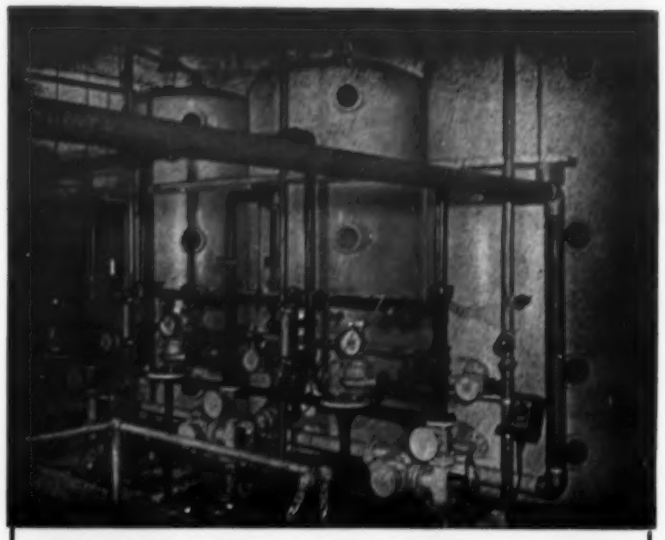

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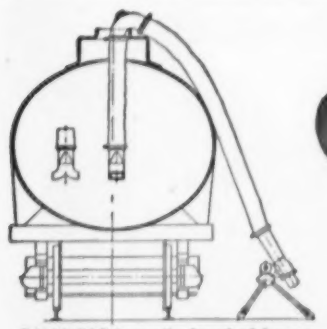

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Lick pump vibration

. . . starts on page 17

low amplitude at a high frequency can cause considerably more noise than the same amplitude at a low frequency.

Sound level measurements were made in the office for various conditions, including the ambient with all pumps shut down.

Units 1, 2, and 3 were run singly. Vibration levels of the motor and pump bearings showed Units 1 and 2 (mounted on cork) to be slightly *higher* than Unit 3 (solid). This was expected because cork allows a pump to vibrate more freely but less vibratory force is transmitted through to the floor. Unit 4 was not run singly because time was short. In any case, the comparison between cork-mounted and solid-mounted units had been established.

cork mounting was partially effective

Vertical vibration of the motor and pump base (at each corner) and of the floor alongside showed a substantial reduction for Units 1 and 2 but very little for Unit 3. This shows cork to be relatively effective.

Pipe vibration on both ends of the rubber hose sections showed very little attenuation through the hose. These hose sections (11 inches long) were slipped over the ends of pipe nipples and clamped with steel bands so that the length between the nipples was about 3 to 5 inches. Hose center sections were banded at close intervals to hold against line pressures up to 150 psig. This stiffened the hose and decreased its isolating efficiency. Units 1, 2, and 3 were helped little by using the hoses.

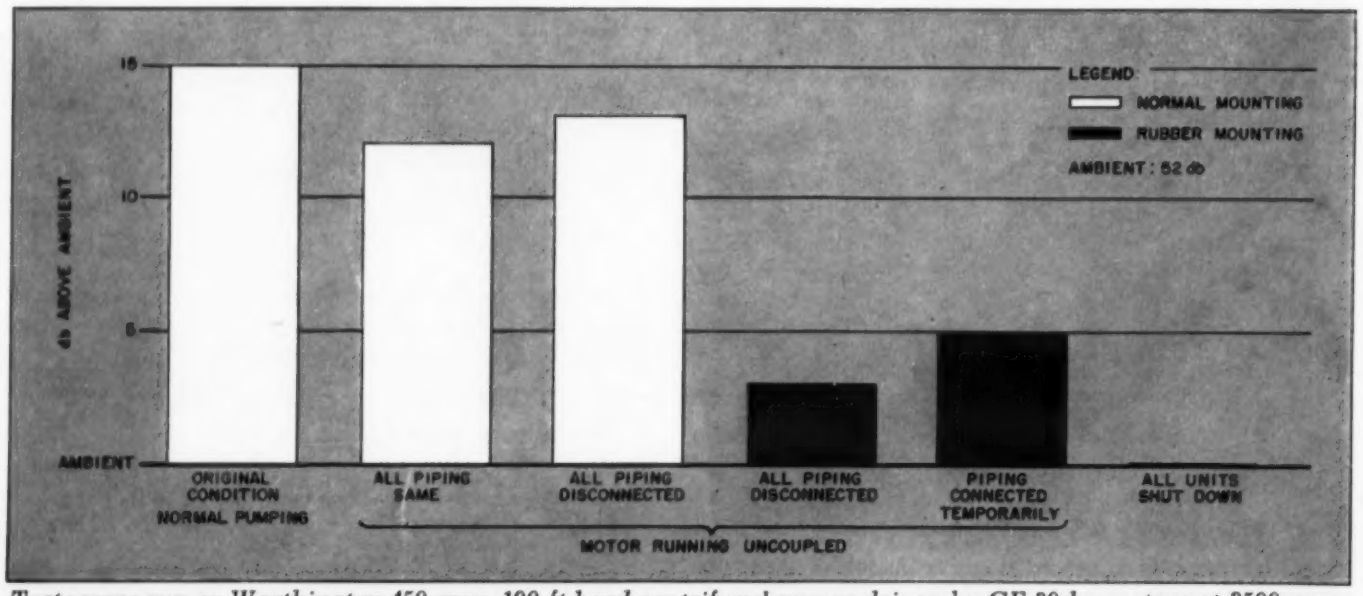
Measurements made on the vibration eliminator pipe hangers with Unit 2 running singly varied from point to point. Fair isolation was obtained in some locations but the benefits were negligible in others. Perhaps this variation in isolating effect was caused by the vibration traveling through some parallel structural path, masking any benefit from these special hangers.

Vibration of the office floor and walls was quite noticeable with a listening probe. Measurements were taken for later comparison.

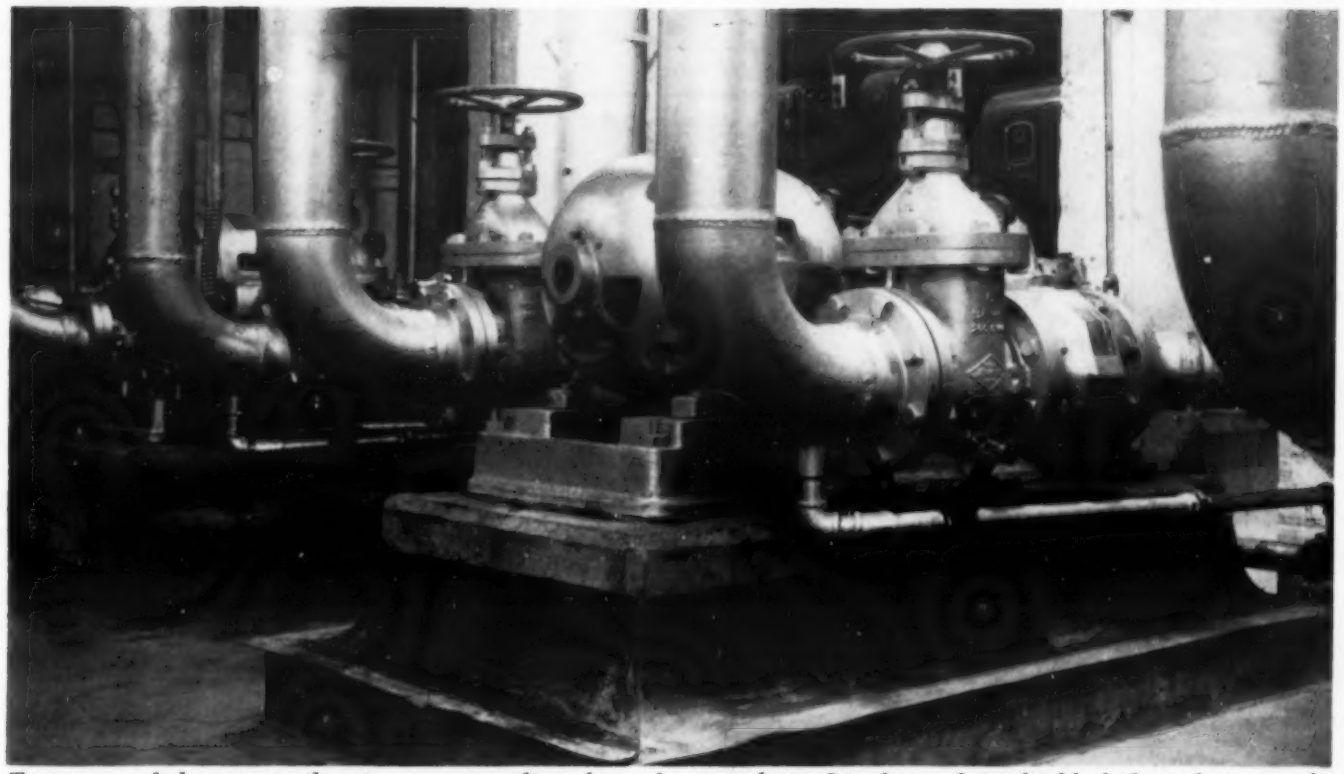
A definite beat frequency was apparent in both noise and vibration inside the pump room and office. This condition emphasized the disturbance and made it more objectionable than a steady tone. This beat frequency (which varied slightly among Units 1, 2, and 3) seemed to be associated with the motors' slip frequencies. This could not be verified, however, because speeds could not be measured accurately.

Several special tests were made to separate the vibration transmission paths and to compare their relative contribution to office noise. First, the pump of Unit 2 was uncoupled and the motor was run alone. Office noise remained about the same, indicating that vibration from the pump itself did not add much to that caused by the motor alone. Motor vibration could have traveled either through the piping or the foundation, so a second change was made. The 6-inch isolating valves for Unit 2 pump were shut, the pump was drained, and both suction and discharge flanges were unbolted and pulled away. Two other paths from the cork-mounted base to the building still existed and also were removed. These were a small drain line for stuffing box leakage and the electrical conduit to the motor. Now, the only vibration path to the building was through the cork. The motor was run alone once more. Office noise remained practically the same as before, proving that the cork was not sufficiently effective.

To isolate a vibrating machine from its foundation,



Tests were run on Worthington 450-gpm, 190-ft head centrifugal pumps driven by GE 30-hp motors at 3500 rpm.



Tests proved that most vibration was traveling through pump base. Linoleum drip shields hide isolating pads.

the machine must be supported by some resilient material so that the resonant frequency of the mounting is low compared with the shaft frequency (⅓ or less). Natural frequency depends on the static deflection of the machine (due to its mass). Greater deflection lowers the frequency.

$$F_n = \frac{188}{D}$$

where F_n = frequency, in cpm
and D = deflection, in inches.

Possibly, in this case, the cork under the pump and motor base was too lightly loaded and did not allow enough static deflection.

A different isolating material, properly loaded for the running frequency involved, was tried next. A 15-sq in. sample of Neoprene Isomode Pad (manufactured by the MB Mfg. Co.) was cut into 4 rectangular pieces to support the 475-pound motor alone at a loading of 32 psi. This cross-ribbed rubber pad is 5/16 inch thick. When loaded to its maximum rating of 50 psi, it is compressed to ¼ inch. At 32-psi loading, the deflection was about 0.040 in. This gave a natural frequency of about 940 cpm or 27% of running frequency. Transmissibility of vibratory forces to the floor was about 8% of original force.

$$\text{Transmissibility} = \frac{-1}{\left(\frac{N}{F_N}\right)^2 - 1}$$

where N = shaft speed, in rpm.

A higher loading of 50 psi would have given even more efficient isolation.

After Unit 2 motor and concrete block had been placed on these pads (not bolted down), the motor was run alone. Office noise was substantially lower than any previous test and only slightly above the ambient level. This indicated that a major portion of the vibration had been traveling through the pump room floor, then up to the office.

test proved piping system not at fault

To determine whether the piping system would become the primary transmission path if pump base was effectively isolated, another test was made. A short section of pipe was jammed between one side of the motor frame and the main pipe system alongside, when the motor was running alone on its four rubber pads. Only a slight increase in office sound level showed that relatively little (if any) change would be required in the piping isolation.

A comparison of office sound levels measured during this investigation is shown on the accompanying chart. Our ears are not very sensitive to low frequency sounds at low decibel levels, so three weighting networks are provided in sound level meters according to the American Standards Association Standard Z24.3 1944. Normally, the "A" weighting is used for low sound levels up to 55 decibels, "B" for 55 to 85 decibels, and "C" for 85 decibels and above.

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Electric Generation: Hydro, Diesel, and Gas-Turbine Stations, edited by B. G. A. Skrotzki; McGraw-Hill Book Company; 458 pages; $8.50.

This book gives a well-rounded introduction to the electric utility industry. It presents, in nontechnical language, a wealth of factual information, ideas, and methods. Mathematics is limited to simple arithmetic, making text ideal as a self-help for beginners as well as a reference for others in this field. Describes fundamentals of steam-electric stations, hydraulic turbines, and gas turbines. Operation, arrangement, and controls for internal combustion engines also are discussed.

Typography and illustrations are above average. Text and illustrations are intended as an introduction to the electric utility industry. Much information may be superfluous to experienced power services engineers. This book fulfills its function as an introductory text.

Proceedings of the American Power Conference, 1956, Volume XVIII; 665 pages; $8.00.

All papers presented at the 1956 American Power Conference, held in Chicago, are reprinted in this volume. Papers give an excellent cross section of the entire power field. Text contains information on all phases from nuclear power plants to cathodic corrosion protection. In addition, question-and-answer discussions held at the conclusion of many sessions are presented. Mathematics showing sample calculations and describing salient points in the text is limited to simple algebra. Wide scope of material contained in this volume makes it an excellent reference book for all Power Services Engineers.

Air Pollution Handbook, edited by Paul L. Magill, Francis R. Holden, and Charles Ackley; McGraw Hill Book Company; 720 pages; $15.00.

An extensive compilation of data plus helpful theoretical, technical, and practical information on air pollution make this a convenient reference handbook. Text discusses causes, effects, and control of air pollution. Gives reader pertinent facts to determine the naure, extent, and effect of air pollution in specific situations and to carry out an effective abatement program.

Readers should have a working knowledge of calculus to obtain maximum benefit from this book.

Applied Electrical Measurements, by Isaac F. Kinnard; John Wiley & Sons, Inc.; 600 pages; $15.00.

This volume gives the reader a broad background in applying electrical measurements. Subject matter is treated within the framework of familiar branches of physics, electricity, light, heat, statics, kinetics, liquids, gases, and time. Text is directed to men who apply the principles of electrical measurements to industrial practice. Methods for analyzing and synthesizing measurement devices and systems are shown. Volume contains extensive bibliography for additional information on individual facets of electrical measurements.

Calculus is employed throughout the text to clarify salient points and demonstrate sample calculations. ♦♦

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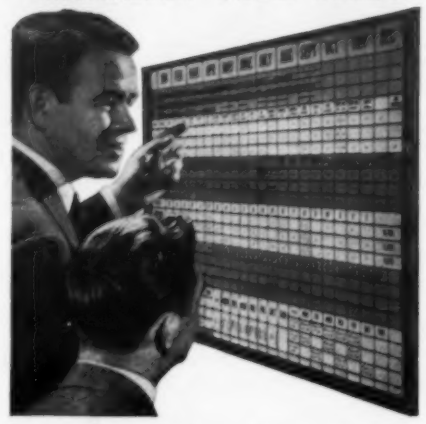

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INDUSTRY POWER February 1957

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"Lights Off"— as simple as this!

The Peabody Type SL Gas-Electric Ignitor...

. . . for fuel burners provides quick, positive and stable ignition for all firing conditions. The simple turning of one handle accomplishes the full operating sequence to establish the ignitor flame.

This ignitor does not employ long electrodes or insulators. All electrical components and adjustable elements are located *outside* the burner windbox; only the flame tube passes through it. All working parts are always readily accessible even when the ignitor is used with a pressurized furnace. This rugged packaged unit, of attractive modern design, is built of the finest materials to give long life with minimum maintenance.

It fills the needs for a dependable, positive and safe ignitor for all types of fuel burners, and is available for manual operation, as illustrated, or with motor drive for remote control. For detailed information, write direct or call your nearest Peabody representative.

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232 MADISON AVENUE, NEW YORK 16, N. Y.
OFFICES IN PRINCIPAL CITIES
PEABODY LIMITED • LONDON, S.W. 1, ENGLAND
6-240
Circle 150 on READ-N-CIRCLE card for more data

handy guide

. . . to advertised products

AIR CLEANING EQUIPMENT

Inside ducts improve gas flow
Read page 37 and circle number 136
PRAT-DANIEL CORP. Plenaflo design gives direct gas flow inside collector casing to cut resistance, gas recirculation.

Dust collectors need no maintenance
Read page 50 and circle number 139
BUELL ENGINEERING CO. Buell LR units give 99+% efficiency. Need no maintenance, no cleaning, no water.

For modern dust collection
Read page 29 and circle number 146
KIRK & BLUM MFG. CO. Read case history of K & B C-3 collector mounted over 3800-cu-ft storage bin that holds 10-days' collection. Write for further details.

AIR CONDITIONING, HEATING, VENTILATING

Keep air fresh
Read page 44 and circle number 116
COPPUS ENGINEERING CORP. Design A ventilator freshens air in confined places.

Banish acid fumes fast
Read page 41 and circle number 126
AEROVENT FAN CO. INC. SP-7 fans move more air with less horsepower. Meet all industry needs. Write for Bulletin 400.

Unit heaters solve heating problems
Read page 35 and circle number 109
REZNOR MANUFACTURING CO. Suspended or floor gas heaters suit heat to your needs.

BOILERS AND BOILER ACCESSORIES

Why not high-temperature water?
Read page 10 and circle number 118
THE INTERNATIONAL BOILER WORKS CO. LaMont forced recirculation generators give efficient, low-cost, high-temperature water.

Improve heat transfer from steam
Read page 24 and circle number 138
COCHRANE CORP. C-B system gives fast, uniform heat transfer, low steam costs.

Replace outmoded water heaters
Read page 30 and circle number 132
PICK MANUFACTURING CO. Instantaneous water heaters suitable for high or low loads.

COMPRESSED AIR SUPPLY

Get drier compressed air
Read page 10 and circle number 107
NIAGARA BLOWER COMPANY. Save cost of cooling water and you save price of Niagara Aero After Cooler in less than two years.

ELECTRIC DISTRIBUTION

For dependable renewable fuses
Read page 43 and circle number 134
MONARCH ELECTRIC CORP. From raw material to final inspection, every part is quality controlled. Write for details.

Fault protection on low voltages
Read pages 6-7 and circle number 123
I-T-E CIRCUIT BREAKER CO. Select from four frame sizes for safe low-voltage protection.

Try new cable and tubing raceways
Read page 32 and circle number 113
THE GLOBE CO. Cable system installs easily, quickly, economically. Always fits. Write for new catalog.

Plan your power for production results
Read page 55 and circle number 101
BULLDOG ELECTRIC PRODUCTS CO. Unit substations supply higher equipment voltages, boost efficiency, save floor space with single unit.

Variable transformers for heavy duty
Read page 9 and circle number 135
THE SUPERIOR ELECTRIC CO. Mail coupon for more information on Powerstats for heavy-duty applications.

It's easy to correct power factor
Read page 40 and circle number 129
SPRAGUE ELECTRIC CO. Put Unipak power-factor correction capacitors right at your motor.

(more handy guide on page 50)

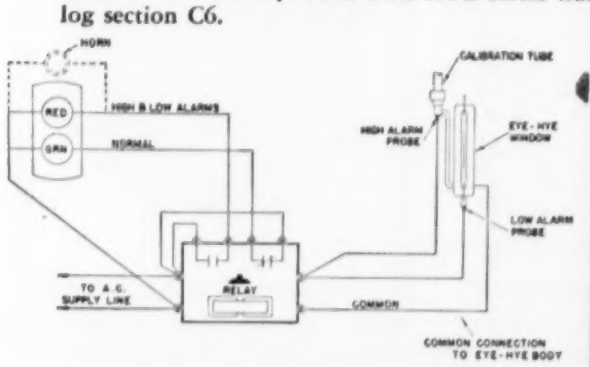
Why not *triple* your boiler water level safety!

Remote reading Reliance EYE-HYE gives you extra sound and sight alarms when you add the Levalarm

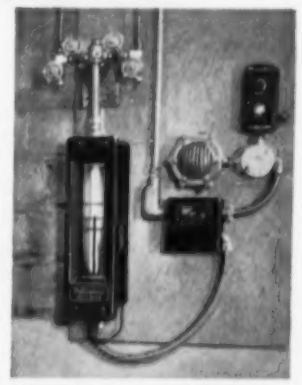
Improve the safety of water level supervision *even more* than EYE-HYE's recognized remote reading advantages; add *extra alarms* at small cost. Reliance electrode Levalarm EA9 augments the illuminated sharp-reading EYE-HYE with vibratory horns or signal lights, or both. They work instantly to alert operators when water levels reach danger points.

The boiler water itself calls the signals! Stainless steel electrodes with teflon insulation pick up a tiny current. Sensitive relays make or break independent circuits that operate the alarms. Levalarms work on low pressure or high.

Reliance Light Indicators, 2-light or 3-light, show green for normal water level — red for dangerous low or high condition. Horns are sturdy noise producers that demand action . . . Low alarm Levalarm can be installed on most EYE-HYEs in service. High alarm facility must be added at our factory. Send EYE-HYE serial number and ask for catalog section C6.



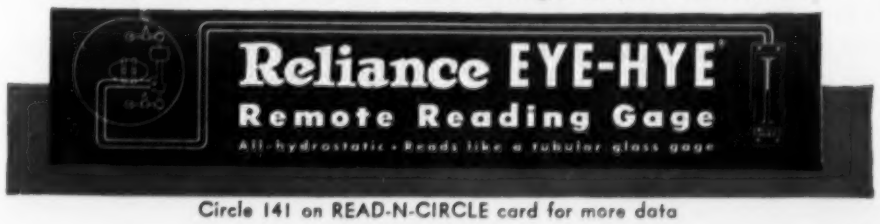
Wiring diagram for high and low alarm hook-up with 2-light indicator and/or horn.



Example of compact hook-up—EYE-HYE with horn and 2-light indicator. The extra signals can be placed any desired distance from the EYE-HYE.

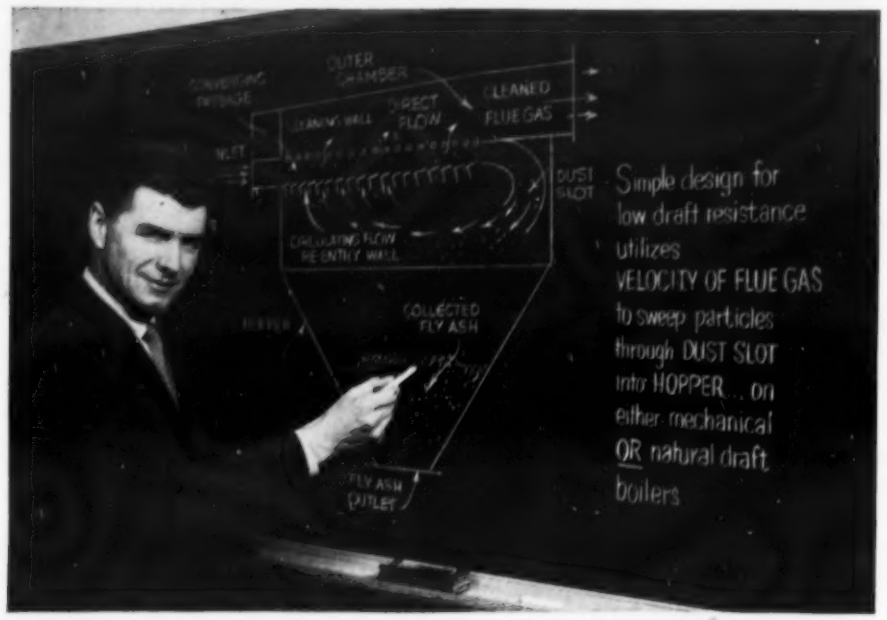
Electrodes used in Levalarm EA9 withstand effects of high temperatures. Require no adjustment.

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

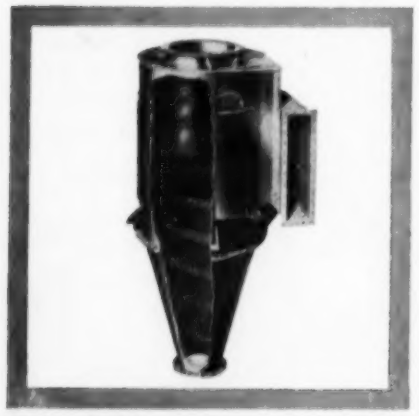


Circle 141 on READ-N-CIRCLE card for more data

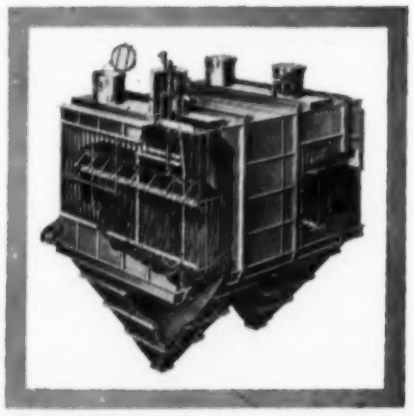
Buell "LR" Collectors deliver top efficiency with no maintenance, no cleaning, no water!


CONVERGING INTAKE
OUTER CHAMBER
CLEANED FLUE GAS
DIRECT FLOW
DUST SLOT
COLLECTED FLY ASH
HOPPER
FLY ASH OUTLET
Simple design for low draft resistance utilizes VELOCITY OF FLUE GAS to sweep particles through DUST SLOT into HOPPER... on either mechanical OR natural draft boilers

Buell "LR" units deliver 99+ percent efficiency in the collection of fly ash of 100 mesh or larger. With no moving parts to get out of order . . . reserve capacity to handle overloads . . . the "LR" Collector is the perfect choice for low and high pressure boiler operations from 100 to 2,000 BHP.



Buell Cyclone Collectors also deliver extra efficiency, due to exclusive shave-off design which harnesses double-eddy and puts it to work!



Buell "SF" Electric Precipitators with exclusive Spiralectrodes and Continuous Cycle Rapping have established brand new concepts in dust collection efficiency.

FREE BOOKLET!
"The Collection and Recovery of Industrial Dusts." Write to: Buell Engineering Company, Dept. 90-B, 70 Pine Street, New York 5, New York

buell®

MECHANICAL ELECTRICAL

Experts at delivering Extra Efficiency in
DUST COLLECTION SYSTEMS

Circle 139 on READ-N-CIRCLE card for more data

handy guide

. . . starts on page 49

Breaker stores in own compartment
Read page 25 and circle number 121
ALLIS-CHALMERS MANUFACTURING CO. Reversible center panel stores molded case breaker in cubicle. Reverse panel to use.

ELECTRIC UTILIZATION

Solve spot heating problem
Read page 36 and circle number 127
EDWIN L. WIEGAND CO. Chromalox line solves three common spot heating problems: flexing, moisture, and abrasion.

FUELS AND FIRING EQUIPMENT

Baffles cut costs
Read page 29 and circle number 125
THE ENGINEER CO. Save fuel and reduce maintenance costs with Enco boiler baffles.

Quick, dependable ignition
Read page 48 and circle number 150
PEABODY ENGINEERING CORP. Use Type SL gas-electric ignitor for fuel burners.

Power to move a world
Read page 33 and circle number 143
BALTIMORE & OHIO RAILROAD. Coal fills need for low-cost energy. B&O delivers the coal.

Dual stage oil burners
Read page 32 and circle number 106
NATIONAL AIROIL BURNER CO., INC. Dual Stage burners have been thoroughly tested and proved in the field.

Have you all the facts?
Read page 38 and circle number 115
MICHIGAN OVEN COMPANY. Send for this book of basic heat processing information written by the specialists — you'll find it useful.

INSTRUMENTS AND CONTROLS

Control oxygen accurately
Read page 36 and circle number 122
ARNOLD O. BECKMAN INC. Investigate complete oxygen analysis systems for higher combustion efficiencies.

Keep continuous oxygen records
Read page 34 and circle number 133
CAMBRIDGE INSTRUMENT CO., INC. Stop unsuspected and costly corrosion with help of continuous records of oxygen dissolved in feedwater.

Fully armored flow indicator
Read page 43 and circle number 114
BROOKS ROTAMETER CO. Handle pressures to 3000 psig, temperatures to 500 F. All-metal flow indicator comes in eight ranges.

Buying pressure controls?
Read page 45 and circle number 131
THE MERCOID CORP. Catalog 857 will make your selection easier. Write for copy.

Triple boiler water level safety
Read page 49 and circle number 141
THE RELIANCE GAUGE COLUMN CO. Remote reading gauge gives extra sound, sight alarms.

Controlled water supply cuts downtime
Read page 31 and circle number 130
JOHNSON SERVICE CO. Johnson controls maintain constant water pressure, temperature. Write for details.

LUBRICATION

For clean, cool-running electric motors
Read page 52 and circle number 148
NEW YORK & NEW JERSEY LUBRICANT CO. Non-Fluid oil lasts longer, gives more protection. Write for details.

MAINTENANCE ITEMS

Better collars give better jobs
Read page 42 and circle number 111
STANDARD PRESSED STEEL CO. Solid steel collars stay put. Held on shaft by Unbrako set screws.

Planned maintenance helper
Read page 46 and circle number 103
GRAPHIC SYSTEMS. Boardmaster Visual Control gives graphic picture of your operations. Saves time and money, prevents errors. Write for booklet.

Free grouting guide
Read page 42 and circle number 124
THE MASTER BUILDERS CO. Free grouting guide shows 11 common machinery settings. Covers proper mixing of grout, hot and cold weather grouting.

Tough grinding made easy
Read page 46 and circle number 119
AIRETOOL MANUFACTURING CO. Grinder is light, rugged. Won't stall or heat up. Write for Bulletin 61.

When you need boiler tubes
Read page 34 and circle number 100
BOILER TUBE CO. OF AMERICA. For fast service on boiler tubes call your nearest Boiler Tube Co. representative.

Tube cleaning equipment
Read page 40 and circle number 117
THOMAS C. WILSON, INC. New 112-page handbook gives data on cleaners for specific equipment in 14 major industries.

MATERIALS HANDLING (BULK)

Prevents bin flow bottlenecks
Read page 11 and circle number 128
GEROTOR MAY CORP. Pulsating neoprene panels inside bins prevent flow bottlenecks. PneuBin units fit inside your present bins.

Super-strong storage bins
Read page 52 and circle number 147
THE NEFF & FRY CO. Super-Concrete stave construction gives bins lateral strength to hold 4000 tons.

PIPING, TUBING, AND HOSE

Seamless metal hose
Read page 37 and circle number 144
COBRA METAL HOSE. Use custom-constructed hose assemblies for your power system. All sizes available in bronze, stainless or carbon steel, Monel, Inconel, and low carbon nickel. Write for information.

Hose, belts give more per dollar
Read pages 26-27 and circle number 108
RAYBESTOS-MANHATTAN, INC. For smooth-running V-belts and light, kinkless hose, try the R/M line.

PUMPING EQUIPMENT

Less maintenance with piston packing
Read page 51 and circle number 102
DARLING VALVE & MANUFACTURING CO. Gain prolonged efficiency, less maintenance with Pumcups for piston packing needs.

Count savings with lower steam cost
Read page 56 and circle number 137
BYRON JACKSON PUMPS INC. BJ mechanical seals save on maintenance costs, cut treated feedwater loss and heat loss.

Solve special pumping problems
Read page 5 and circle number 115
PHILADELPHIA PUMP & MACHINERY CO. Investigate pump line specifically for high-pressure techniques.

Handling heavy fuel oils?
Read page 39 and circle number 112
TUTHILL PUMP CO. SU pump unit handles heavy fuel oils. Large choice of pumps and motors. Write for more information.

TRAPS, STRAINERS, AND SEPARATORS

Stainless steel filters and strainers
Read page 37 and circle number 110
RONNINGEN-PETTER CO. Quick coupling, non-short-circuiting filters and strainers come in multiplex units to 2500 gpm.

Vent air from hot water, liquids
Read page 45 and circle number 149
ARMSTRONG MACHINE WORKS. Vent air from hot water, gas, or liquid. Send for free bulletin giving complete details.

VALVES AND REGULATORS

Blow-off valves for high-pressure boilers
Read page 8 and circle number 140
YARNALL-WARING CO. Yarway valves meet application needs, give dependable service.

WATER SUPPLY AND TREATMENT

Demineralizers built in all sizes
Read page 44 and circle number 120
HUNGERFORD & TERRY, INC. A complete line of water conditioning systems is available. Investigate these fully guaranteed, highest quality units by writing for details now.

Demineralization troubles?
Read page 2 and circle number 105
INFILCO INC. Infilco custom-builds demineralizers to meet your specific problems. Write for the complete story.

High-pressure boilers need pure water
Read page 35 and circle number 104
ILLINOIS WATER TREATMENT CO. Illco-Way ionXchange equipment cleans up muddiest river water for top boiler performance.

Cut pipe scaling, sludge, corrosion
Read page 4 and circle number 145
DEARBORN CHEMICAL CO. Right water conditioning program solves troubles from corrosive elements of water. Write for full details. ♦♦

2-way gain with PUMCUPS

Cross-section of conventional and 45° bevel type Pumcups.

Darcova Pumcups are available in various types and textures, in a complete range of sizes, to provide unequalled efficiency and long life in reciprocating pumps, air or hydraulic mechanisms.

★ prolonged high efficiency
★ less maintenance

TODAY hundreds of companies using hydraulic controls, air cylinders or reciprocating pumps are *standardizing* on Darcova Pumcups for piston packing, because they eliminate fluid slippage, costly down-time and maintenance.

Darcova Pumcups make the *most* of the cup packing principle. And, they are made in a complete range of sizes, types and texture-engineered compositions for various pressure-temperature-fluid conditions. Pumcups hold peak efficiency for the life of the cups and outlast other packing as much as 3 to 1.

Why not check these claims right in your own plant? Meanwhile get *all* the facts. Just send for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 9, Pa.

DARCOVA — THE ORIGINAL COMPOSITION CUP
TRADE MARK PUMCUPS

Circle 102 on READ-N-CIRCLE card for more data

NON-FLUID OIL

TRADE MARK REGISTERED

FOR CLEANER, COOLER-RUNNING ELECTRIC MOTORS

Besides keeping motors cooler, without the messy slinging and dripping of ordinary lubricants, NON-FLUID OIL lasts longer—providing better lubrication at less cost per month. Furthermore, it avoids the bother and expense of burn-outs and shorts caused by oil-soaked insulation.

NON-FLUID OIL *stays alive longer* than regular greases, retaining its high lubricating properties until entirely used up . . . outlasts ordinary lubricants 3 to 5 times, without drying out or hardening.

Try NON-FLUID OIL in your own equipment. Free sample and Bulletin 504 on request (specify application).

NEW YORK & NEW JERSEY LUBRICANT COMPANY

292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.

1898 61 1951 YEARS OF LUBRICATION SERVICE NON-FLUID OIL TO INDUSTRY

WAREHOUSES

Birmingham, Ala. Atlanta, Ga. Charlotte, N. C. Greenville, S. C. Columbus, Ga. Springfield, Mass. Detroit, Mich. St. Louis, Mo. Providence, R. I. Chicago, Ill. Greensboro, N. C.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 148 on READ-N-CIRCLE card for more data

There's a heavy conveying system atop these Neff and Fry Bins

A continuous reinforced concrete roof on the six 20' x 52½' bins carries a big screw conveyor with piers, chutes, etc. Observe that there are no additional supports from the ground. The bins themselves support the entire load.

This strikingly proves the load-bearing strength of Neff & Fry Bins. Of course, the bins also have the lateral strength to contain 4,000 tons of grain.

The walls of Neff & Fry Bins are constructed of Super-Concrete Staves. For a complete understanding, read our folder, "Bins With the Strength of Pillars." Ask for it now before you forget.

NOT EXPORTED
EXCEPT TO CANADA AND MEXICO

THE NEFF & FRY CO.

120 ELM ST. • CAMDEN, OHIO

Circle 147 on READ-N-CIRCLE card for more data

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Single copies of following reprints are available free. Quantity orders for individual reprints quoted on request. Address all correspondence, on company letterhead, please, to Reader Service Department, INDUSTRY POWER, Shepard-Benning Building, St. Joseph, Michigan.

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- *Electric Drives Control Coal Feed to Dryers*
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- *For Better Lighting at Less Cost, Frost Your Windows*
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- *Hot Materials Demand Special Conveyor*
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- *Standard Switchgear Offers Tailormade Job Fast*
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- *Tailor-Made Fire Protection*
- *Television . . . The Eyes of Industrial Control*
- *What To Do About Anion Resin Deterioration*
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AEROVENT FAN CO. INC. .....Page 41

PIQUA, OHIO: (Home Office) Ash and Boyd Sts.

AIRETOOL MFG. CO. .....Page 46

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COCHRANE CORP. .....Page 24

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Feb. 15-16	NSPE Spring Meeting	Hotel Francis Marion, Charleston, S. C.
Feb. 17-23	National Engineers Week	
Feb. 18-21	Industrial Ventilation Conference	Kellogg Center, Michigan State University, East Lansing.
Feb. 18-22	ASCE Sectional Meeting	Jackson, Miss.
Feb. 25-Mar. 1	ASHAE International Exposition	International Amphitheatre Chicago
Mar. 3-6	AICE Convention	Greenbrier Hotel, White Sulphur Springs, Va.
Mar. 10-16	Nuclear Congress and Atomic Exposition	Convention Hall, Philadelphia
Mar. 11-15	NACE Annual Convention	Kiel Auditorium, St. Louis

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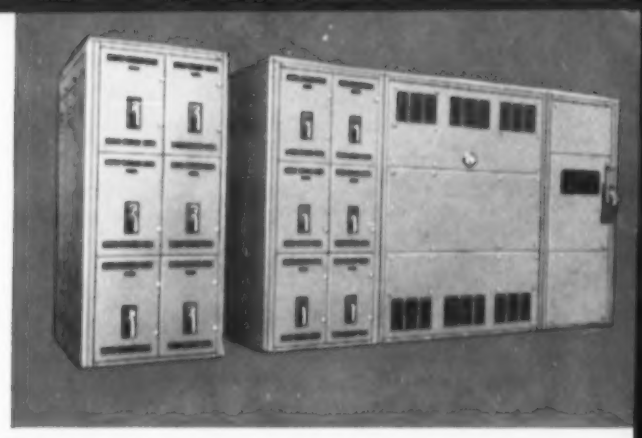

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New BullDog secondary Unit Substations answer vital needs in the operation of modern industrial plants. They bring the overall economies of high-voltage distribution—plus providing adequate facilities for future expansion. And by bringing higher voltages closer to consuming equipment, Unit Substations boost machine efficiency to maximum productivity. Valuable floor space is saved, too, through an integrated unit which houses transformer, switchgear and other components.

Let the BullDog field engineer give you all the facts—show you how Unit Substations are the starting point of a *planned* power system by BullDog, which adds materially to plant safety, economy, and production efficiency! © BEPCO

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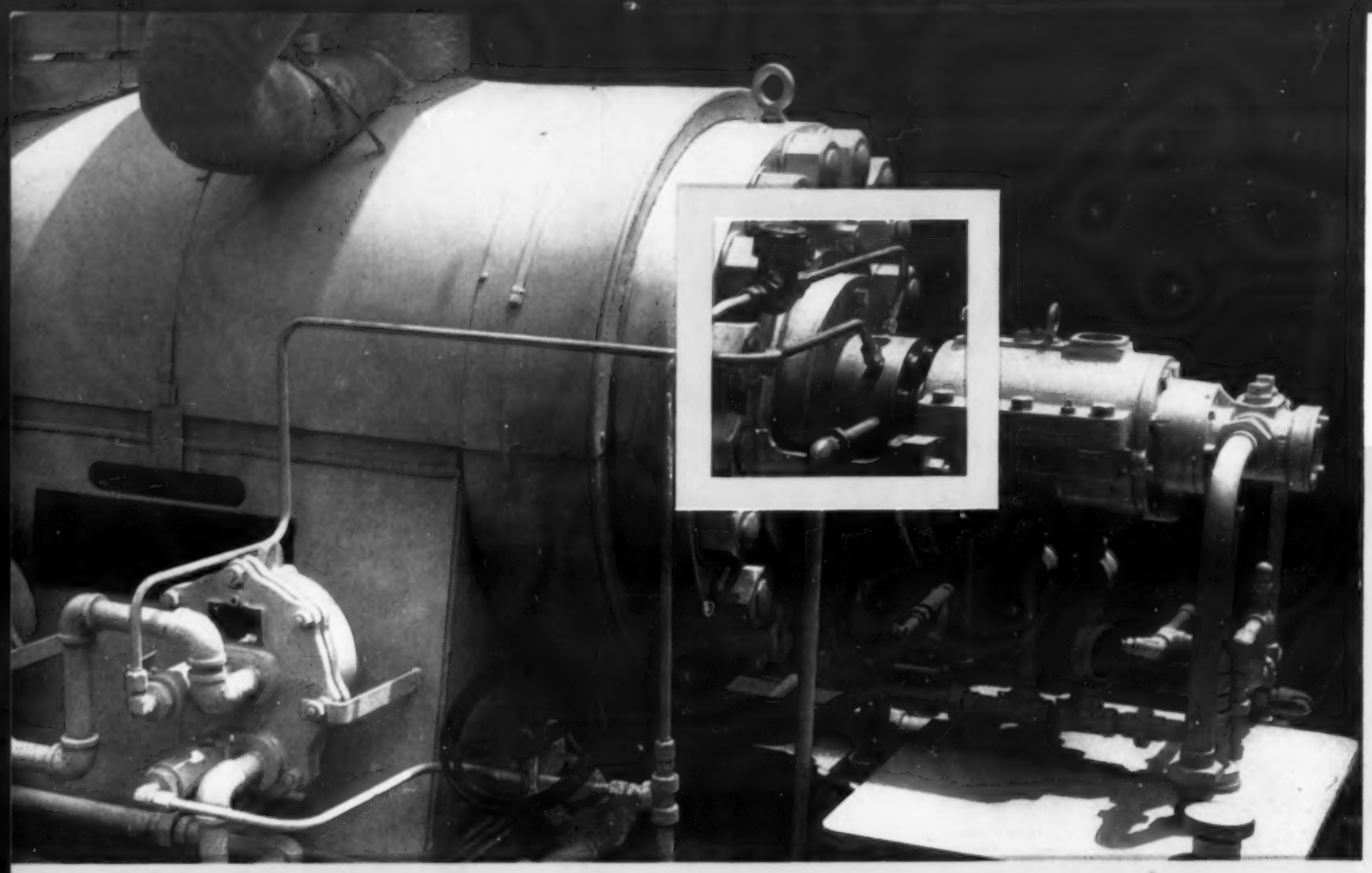

City of Pasadena realizes

Big Savings on Boiler Feed with BJ Mechanical Seals

The City of Pasadena Light and Power Department has been using BJ Mechanical Seals in high temperature, high pressure boiler feed service for more than a year. These seals are installed on three double case boiler feed pumps with suction pressures to 400 psi, temperatures of 427° F. and an operating speed of 3550 rpm. The seals incorporate a pumping ring and small Graham Heliflow heat exchanger. Here are the results:

1. **SAVINGS ON MAINTENANCE**—Stuffingbox maintenance has been completely eliminated since installation of the seals. There has been no repacking labor cost... no pump shut-down loss.

2. **SAVINGS OF TREATED FEED WATER**—Previous to BJ Mechanical Seal installation, considerable loss of expensive, prepared feed water occurred. Now leakage loss is imperceptible.

3. **SAVINGS OF HEAT**—BTU's formerly lost through stuffingbox leakage are now sealed in for greater overall boiler feed operating efficiencies.

YOU CAN ACTUALLY COUNT THE SAVINGS IN LOWER COST OF KILOWATTS!

If you are operating high temperature, high pressure boiler feed pumps it will pay you to investigate now the big savings available from BJ Mechanical Seal installation.

Contact your BJ Pump Sales Engineer or write:

BYRON JACKSON PUMPS
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